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STUDIES OF PACIFIC ISLAND PLANTS, XVI NOTES ON FIJIAN RUBIACEAE¹

A. C. SMITH

THE PRESENT PAPER is intended primarily to place on record the apparently undescribed species of Fijian Rubiaceae collected by the writer in 1947.² Twenty species are here described as new, in the genera *Gardenia*, *Ixora*, and *Psychotria*. No effort is here made toward a revision of the family on a local scale, but field observation inclines me to believe that such a revision will not prove difficult. When all the Fijian types are brought together for comparison with the abundant material now available, it should be possible to delimit and correlate the local species with accuracy. In spite of the fact that it is the largest family of phanerogams in Fiji, the Rubiaceae does not present insurmountable taxonomic problems. Differences of opinion as to the rank of categories may remain for some time, but the taxa appear in general to be well delimited.

The place of deposit of specimens is indicated by: A (Arnold Arboretum), US (U. S. National Museum).

HEDYOTIS L.

Hedyotis tenuifolia Sm. in Rees, Cycl. 17: no. 19. 1811.

Oldenlandia tenuifolia sensu Forst. f. Fl. Ins. Austr. Prodr. 11. 1786; non Burm. Fl. Ind. 37. pl. 14, fig. 1. 1768.

VANUA LEVU: M a t h u a t a : Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, alt. 100–200 m., *Smith 6886* (A, US) (on edge of pond in open rolling country; corolla white).

I am indebted to Dr. F. R. Fosberg for pointing out the identity of this interesting little plant, which, in my observation, is rare in Fiji; at least

¹ No. XV of this series was published as vol. 30, part 5 (pages 523–573), of Contributions from the U. S. National Herbarium, 1953.

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I have seen it only in the cited locality. However, Seemann noted the species as "Common on roadsides throughout Viti."

Smith's binomial of 1811 is based upon Forster's interpretation of *Oldenlandia tenuifolia* Burm. and his concept is based entirely upon Forster's specimen from Tanna, in the New Hebrides. *Oldenlandia tenuifolia* Burm. is said by Smith to be a very different plant, which he refers to *Hedyotis herbacea*. Of course, by modern nomenclatural practice, Smith could not have based his binomial upon Forster's interpretation of an earlier name to the exclusion of the actual type of that concept, and therefore Forster cannot be cited as the parenthetical author. However, there is no obstacle to the acceptance of Smith's *Hedyotis tenuifolia* as a new species, dating from 1811 and based entirely upon Forster's Tanna specimen. Previous mention of the occurrence of the species (as *Oldenlandia tenuifolia* Forst. non Burm.) in the New Hebrides and Fiji is to be found also in the following works: DC. Prodr. 4: 425. 1830; Seem. Fl. Vit. 126. 1866; Drake, Ill. Fl. Ins. Pac. 186. 1886; Guillaumin in Bull. Soc. Bot. Fr. 74: 698. 1927.

GARDENIA Ellis

Gardenia candida sp. nov.

Arbor ad 7 m. alta, ramulis gracilibus, inferne subteretibus cinereis glabris, internodiis distalibus leviter angulatis 2–3 mm. diametro pilis pallidis 0.1–0.3 mm. longis puberulis; stipulis longe persistentibus in tubum 9–11 mm. longum pilis ad 0.5 mm. longis puberulum vel setulosum apice undulatum connatis; petiolis liberis semiteretibus superne leviter canaliculatis 2.5–3.5 cm. longis ut ramulis juvenilibus puberulis; foliorum laminis chartaceis in sicco viridibus, ellipticis, (12–) 15–20 cm. longis, (5–) 6–9 cm. latis, basi acutis et in petiolum decurrentibus, in acuminem obtusum ad 1 cm. longum apice cuspidatis, margine integris, supra costa nervisque secundariis plus minusve puberulis exceptis glabris, subtus pilis patentibus pallidis 0.2–0.4 mm. longis uniformiter et persistenter puberulis, costa valida supra elevata subtus prominente, nervis secundariis utrinsecus 15–17 patentibus marginem versus curvatis et interconnexis utrinque elevatis, nervis tertiariis numerosis inter secundarios transversis et rete venularum utrinque prominulis; floribus magnis in axillis distalibus solitariis, pedicello crasso subtereti sub anthesi 1–1.5 cm. longo cum calyce pilis pallidis 0.3–0.7 mm. longis copiose patenti-piloso; calyce infundibulari sub anthesi lobis inclusis 3.5–4 mm. longo et apicem versus circiter 2.5 mm. diametro, tubo parvo obconico, limbo chartaceo vel subcoriaceo elongato dorso 4-alato, alis semiobovatis circiter 2.5 cm. longis et 1 cm. latis conspicue nervatis apice rotundatis apicem limbi ipsi scariosum et undulatum 5–10 mm. excedentibus; corolla in vivo subcarnosa hypocrateriformi, tubo 4.5–5 cm. longo et basi circiter 4 mm. diametro faucibus ad 1 cm. ampliato, extus glabro vel obscure puberulo, intus ad lineas staminibus alternatas pilis debilibus adscendentibus 1–2 mm. longis copiose piloso, limbo patenti sub anthesi rotato 9–11 cm. diametro ad basim 8-lobato, lobis late imbricatis oblongis

ad 5 cm. longis et 2–2.5 cm. latis apice rotundatis; staminibus 8, antheris sessilibus anguste oblongis circiter 17 mm. longis et 1.5 mm. latis, dorso complanatis, a tubo corollae leviter exsertis; stylo crasso clavato quam tubo corollae paullo brevior demum in stigmata 4 circiter 1 cm. longa dorso minute strigillosos fissos.

VANUA LEVU: Mathuata: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, alt. 100–200 m., Nov. 25, 1947, *Smith 6640* (A TYPE, US) (*ndrenga*; tree 7 m. high, in patches of forest in open rolling country; corolla-lobes pure white, the tube greenish).

Species of *Gardenia* are among the more obvious components of the flora of the Mathuata coast of Vanua Levu. Their abundance in the patches of forest that occur here and there in this comparatively dry region, together with the pervasive fragrance of their flowers, imparts a characteristic charm to the landscape. Species known to occur in Mathuata are *G. vitiensis* Seem., *G. gordonii* Baker, *G. grieviei* Horne ex Baker, and *G. hillii* Horne ex Baker. The species here described cannot be confused with any of these nor with the several others known from Viti Levu. Superficially *G. candida* is most like *G. gordonii*, but it differs in the indument of its leaves, pedicels, and calyx, and in its even larger flowers.

MASTIXIODENDRON Melchior

Mastixiodendron pilosum A. C. Sm. in Jour. Arnold Arb. 26: 109. 1945.

VANUA LEVU: Mathuata: Southern base of Mathuata Range, north of Natua, alt. 100–250 m., *Smith 6781* (A, US) (slender tree 8 m. high, in dense forest; mature fruit dull yellow).

The third known collection of the species agrees very well with the two earlier ones, which are similarly in fruiting condition. Previously the species has been known with certainty only from the province of Mbua, Vanua Levu.

IXORA L.

Ixora pedionoma sp. nov.

Arbor ad 2 m. alta, ramulis gracilibus apices versus complanatis 1–1.5 mm. diametro pilis 0.1–0.3 mm. longis patenti-puberulis, vetustioribus subteretibus cinereis glabratiss, internodiis 5–10 mm. longis; stipulis liberis e basi late ovato aristatis 4–5 mm. longis ut ramulis puberulis; foliis glabris subsessilibus, petiolis canaliculatis 1–3 mm. longis, laminis chartaceis siccitate olivaceis lanceolatis, 4–9 cm. longis, 1–2 cm. latis, basi attenuatis et in petiolum decurrentibus, apice in mucronem callosum 0.5–1 mm. longum angustatis, margine integris leviter incrassatis, utrinque levibus, costa supra valde elevata subtus prominente, nervis secundariis utrinsecus 8–12 subadscendentibus utrinque prominulis vel supra planis, rete venularum immerso vel subtus prominulo; inflorescentiis in ramulis brevibus terminalibus 3-floris, basi bracteis binis foliaceis subtentis, bracteis papyraceis ovatis, (15–) 18–25 mm. longis, (10–) 12–15 mm. latis, basi sub-

cordatis, apice cuspidatis, reticulato-nervatis; pedicellis teretibus 1–1.5 mm. longis ut calyce copiose pallido-puberulis; calyce sub anthesi circiter 3 mm. longo, limbo erecto, lobis 4 deltoideis obtusis haud 0.5 mm. longis; corolla hypocrateriformi glabra, tubo gracillimo (haud 1 mm. diametro) circiter 25 mm. longo, lobis 4 patentibus oblongis subacutis 8–8.5 mm. longis circiter 3 mm. latis; staminibus exsertis glabris, filamentis ligulatis 1–1.5 mm. longis, antheris anguste oblongis 4–5 mm. longis; stylo gracillimo exserto parte inclusa puberulo, stigmatibus complanatis circiter 2 mm. longis; fructibus ellipsoideis ad 5 mm. diametro persistenter puberulis calycis limbo coronatis.

VANUA LEVU: Mathuata: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, alt. 100–200 m., Nov. 28, 1947, *Smith 6703* (A TYPE, US) (shrub 1–2 m. high, along river in patches of forest in open rolling country; corolla and style white).

The new species (of § *Phylleilema*) is a very close relative of *I. nandari-vatensis* Gillespie, in comparison with which it has its branchlets distally and its shorter stipules puberulent, its leaves comparatively short-petioled, proportionately narrower, and smooth rather than bullate in texture, its inflorescence-bracts larger, and its corolla with a very slender, longer tube and larger lobes.

Ixora decora sp. nov.

Arbor ad 4 m. alta, ramulis apices versus gracilibus 1.5–3 mm. diametro complanatis parce puberulis mox glabrat, vetustioribus teretibus cinereis, internodiis plerumque 2–5 cm. longis; stipulis glabris vel minute puberulis in tubum brevem subcoriaceum circiter 2 mm. longum biaristatum (aristis circiter 2 mm. longis) caducum connatis, basi intus pilis circiter 0.7 mm. longis ornatis; foliis glabris, petiolis gracilibus canaliculatis 8–16 mm. longis, laminis rigide chartaceis in sicco fusco-olivaceis, oblongo-lanceolatis, (6–) 9–13 cm. longis, (2–) 2.5–4 cm. latis, basi acutis vel attenuatis et in petiolum decurrentibus, apice rotundatis vel obtusis vel obtuse cuspidatis apice ipso obscure calloso-mucronulato, margine integris, costa supra impressa vel in sulcula elevata subtus prominente, nervis secundariis utrinsecus 12–14 patentibus marginem versus anastomosantibus supra subplanis subtus prominulis, rete venularum plerumque immerso; inflorescentiis terminalibus trichotome corymbosis multifloris ad 9 cm. longis et 13 cm. diametro, radorum pedunculis gracilibus glabris ad 5 cm. longis, ramulis infimis subtrichotomis haud articulatis minute et sparse puberulis, bracteolis paucis inconspicuis subulatis ad 1 mm. longis; pedicellis sub fructu 0.5–3 mm. longis, bracteolis basi ovarii insertis minutis 0.2–0.3 mm. longis; calyce ovario incluso cupuliformi minute puberulo paullo post anthesin 1–1.5 mm. longo, limbo minuto, lobis 4 rotundatis haud 0.2 mm. longis; corolla in alabastro 4-lobata lobis extus minute puberulis; fructibus globosis in sicco rugulosis glabris ad 7 mm. diametro, calycis limbo minuto coronatis.

VANUA LEVU: Mathuata: Southern slopes of Mt. Numbulua, east of Lambasa, alt. 100–350 m., Oct. 27, 1947, *Smith 6376* (A TYPE, US) (tree 4 m. high, in open forest; fruit red).

The new species (§ *Pavettopsis*) is of the general relationship of *I. elegans* Gillespie, having a similar type of inflorescence, stipule, etc. However, it differs from *I. elegans* in its shorter stipules, its oblong-lanceolate leaf-blades that are proportionately narrower and rounded or obtuse at apex (the apices in *I. elegans* being gradually narrowed and predominantly acute), and the very obscure indument of its inflorescences. Another species of this relationship, *I. tubiflora* A. C. Sm., differs from *I. decora* in its more conspicuously aristate stipules, as well as in foliage characters and in its glabrous calyx with comparatively conspicuous lobes.

Ixora myrsinoides sp. nov.

Arbor ad 8 m. alta, ramulis teretibus cinereis glabris apicem versus circiter 2 mm. diametro interdum in internodiis distalibus inconspicue complanatis; stipulis subcoriaceis glabris circiter 5 mm. longis e basi late ovata aristatis, basi lateraliter haud connatis, arista dorsali 2–3 mm. longa; foliis glabris, petiolis gracilibus canaliculatis 1.3–2.3 cm. longis, laminis chartaceis in sicco olivaceis oblongo-ellipticis, (10–) 12–16 cm. longis, (5–) 6–8 cm. latis, basi obtusis sed subito angustatis et in petiolum manifeste decurrentibus, apice acutis et callosomucronulatis, margine integris et leviter recurvatis, costa supra paullo impressa subtus prominente, nervis secundariis utrinsecus 8–12 patentibus leviter curvatis marginem versus anastomosantibus supra subplanis subtus elevatis, rete venularum utrinque manifeste prominulo; inflorescentiis terminalibus subsessilibus trichotome corymbosis sub anthesi floribus inclusis ad 5.5 cm. longis et 9 cm. diametro, pedunculo 2–3 mm. longo, bracteis primariis oblongo-lanceolatis vel obovatis 7–15 mm. longis, radorum pedunculis ad 1.5 cm. longis et ramulis infimis subtrichotomis glabris, bracteolis ad 2 mm. longis infimis subulatis minoribus; pedicellis sub anthesi 2–4 mm. longis vel subnullis, bracteolis basi ovarii insertis 0.3–1 mm. longis; calyce ovario incluso anguste cupuliformi sub anthesi 3.5–4 mm. longo obscurissime puberulo, limbo erecto lobis 4 oblongo-deltoides obtusis 0.7–0.9 mm. longis inclusis 1.5 mm. longo intus minute strigilloso; corolla subcarnosa glabra hypocrateriformi, tubo circiter 15 mm. longo et basi 1.3 mm. diametro superne paullo ampliato, lobis 4 patentibus oblongis obtusis circiter 9 mm. longis et 4 mm. latis; staminibus exsertis glabris, filamentis gracilibus 2–3 mm. longis, antheris anguste oblongis 7–8 mm. longis; stylo gracillimo exserto medium versus obscure puberulo superne incrassato, stigmatibus circiter 2 mm. longis; fructibus subglobosis in sicco rugulosis glabrescentibus ad 9 mm. diametro calycis limbo coronatis.

VITI LEVU: Mba: Northern slopes of Mt. Namendre, east of Mt. Koromba [Pickering Peak], alt. 750–900 m., May 27, 1947, *Smith 4529* (A TYPE, US) (tree 8 m. high, in dense forest; corolla white, the lobes faintly pink-tinged; fruit at length purple).

The closest relative of *I. myrsinoides* (§ *Pavettopsis*) is apparently *I. tubiflora* A. C. Sm., from which it differs in the shorter aristae of its stipules, its much more compact inflorescence, its puberulent calyx with slightly shorter lobes, and its corolla with a shorter tube but larger lobes. Other related species, *I. elegans* Gillespie and *I. harveyi* (A. Gray) A. C. Sm., are readily distinguished from *I. myrsinoides* in details of leaf-shape, calyx-lobes, and in their comparatively small corollas.

***Ixora greenwoodiana* sp. nov.**

Arbor gracilis ad 10 m. alta vel frutex, ramulis gracilibus cinereis subteretibus apices versus 1.5–2 mm. diametro inconspicue puberulis mox glabrescentibus, internodiis plerumque 1–3 cm. longis; stipulis subcoriaceis mox glabris 3.5–5 mm. longis e basi late ovata aristatis, basi lateraliter breviter connatis, arista 1.5–3 mm. longa; petiolis gracilibus canaliculatis 7–12 mm. longis minute puberulis vel in sulcula glabris; foliorum laminis chartaceis in sicco olivaceis, elliptico- vel obovato-lanceolatis, 9–13 cm. longis, 3.5–5 cm. latis, basi attenuatis et in petiolum decurrentibus, apice cuspidatis et calloso-mucronulatis, margine integris et anguste recurvatis, supra glabris, subtus pilis pallidis haud 0.05 mm. longis persistentibus minute sed dense et uniformiter puberulis, costa supra leviter impressa subtus prominente, nervis secundariis utrinsecus 8–12 erecto-patentibus leviter curvatis inconspicue anastomosantibus supra prominulis subtus elevatis, rete venularum supra prominulo subtus plerumque immerso; inflorescentiis e ramulis brevibus terminalibus trichotome corymbosis sub fructu ad 6 cm. longis et 10 cm. diametro, pedunculo 3–5 mm. longo arcte puberulo, bracteis primariis obovatis foliaceis ad 2 cm. longis, radiorum pedunculis ad 2 cm. longis et ramulis infimis subtrichotomis minute puberulis; pedicellis paullo post anthesin et sub fructu ad 2 mm. longis vel subnullis, bracteolis basi ovarii insertis subulatis 0.3–1 mm. longis puberulis; calyce ovario incluso oblongo-cupuliformi paullo post anthesin 2.5–3 mm. longo dense sed minute puberulo, limbo suberecto lobis 4 deltoideis obtusis 0.5–0.7 mm. longis inclusis circiter 1 mm. longo intus obscure strigilloso; corolla non visa; fructibus subglobosis ad 8 mm. diametro in sicco rugulosis obscure puberulis calycis limbo coronatis.

VITI LEVU: Mba: Eastern slopes of Mt. Koroyanitu, Mt. Evans Range, alt. 950–1050 m., May 2, 1947, *Smith 4249* (A TYPE, US) (slender tree 10 m. high, in dense low forest; fruit becoming pink); Mt. Evans Range, alt. about 1150 m., *Greenwood 939* (A) (shrub, to 3 m. high; young leaves golden-brown, the flower-buds deep red).

The new species (of § *Pavettopsis*) suggests *I. harveyi* (A. Gray) A. C. Sm. in the size and shape of its leaves and their narrowed bases, but it differs in the close but uniform indument of the lower surfaces of leaves (the leaves of *I. harveyi* being strictly glabrous), in its more ample and puberulent inflorescence, and in its pilose calyx with comparatively short lobes. Other Fijian species of § *Pavettopsis* with leaves pilose beneath are *I. maxima* Seem. and *I. pubifolia* A. C. Sm., but both of these have more

pronounced foliar and inflorescence indument and substantially larger leaves. *Ixora greenwoodiana* differs from *I. myrsinoides*, described above, not only in the foliage indument, but also in the short petioles, the considerably smaller leaf-blades more gradually narrowed at base, and the smaller calyx-limb.

Ixora bullata Turrill in Jour. Linn. Soc. Bot. 43: 25. 1915.

VANUA LEVU: Mathuata: Summit ridge of Mt. Numbuloa, east of Lambasa, alt. 500–590 m., *Smith 6414* (A, US) (shrub or slender tree 2–4 m. high, in dense forest; inflorescence compact, deep red).

The extraordinary species described by Turrill bears little resemblance to other Fijian *Ixorae*; our specimens have some of the leaves even more extreme in size (up to 40×3 cm.) than those originally described. Apparently the species is otherwise represented only by the type, collected in southeastern Viti Levu (*im Thurn 359*, at Kew).

PSYCHOTRIA L.

Psychotria, the largest genus of phanerogams in Fiji, has had referred to it more than 60 binomials based on material from the archipelago. Some of these have been reduced outright and others are now referred to varietal status, but there remain in Fiji at least 55 described species of *Psychotria* which seem readily distinguishable. Particular efforts were made during my 1947 trip to obtain material of as many *Psychotriae* as possible, with a view to clarifying the status of various inadequately known species. Many, if not most, of the older species were re-collected, and it was gratifying to observe that certain species, hitherto considered rare, are in fact locally quite abundant. Of other species a second or third known collection was obtained, but there still remain several Fijian species known only from the type collection. It is hoped that future collectors will pay particular attention to this complex genus, which, in my opinion, can be locally understood by the examination of all types in connection with abundant new material. Most of the species appear to be sharply delimited, and one may suspect that much of the confusion in herbaria is due to misinterpretation of types or attempts to expand species concepts beyond reasonable limits. In the present treatment I describe 15 species as new; thus the genus now includes approximately 70 Fijian species, a number which will almost certainly be substantially increased by future collecting.

Careful consideration of all the Fijian species of *Psychotria* with various types of enlarged calyces inclines me at present to agree with Fosberg's reduction of my genera *Calycodendron* and *Eumorphanthus* (cf. *Sargentia* 1: 125. 1942). The calyx appears to be a highly variable feature in *Psychotria*, although it is reasonably constant within species. The Fijian species that have the calyx-limb much exceeding the tube show several trends of development, but these are not necessarily stages along one line of evolution, and consequently the single character of a showy calyx-limb probably does not justify generic segregation. An extreme development

of the calyx-limb is found in *P. eumorphanthus* and approached in *P. confertiflora*, these species also being characterized by very large, 4-angled fruits. To this group two new species are added in the present paper. Species with a large calyx-limb abruptly flattened, or essentially rotate nearly from the base, are very striking on the basis of this character; this group ("*Calycodendron*") includes *P. glabra*, *P. magnifica*, *P. fragrans*, and *P. rufocalyx*. A somewhat similar calyx-limb, but campanulate or crateriform rather than subrotate, occurs in *P. pubiflora*, *P. milnei*, and *P. gibbsiae*. Species which resemble the latter group in this character but have the calyx smaller are *P. neurocalyx*, *P. calycosa*, and *P. gillespieana*. *Psychotria vitiensis* must also be associated with this group, although its calyx-limb is erect and fusiform, abruptly flaring only at the apex. The species here mentioned, together with several novelties of this relationship, would have to be associated in *Calycodendron* if that genus were maintained, but I think that Fosberg is probably correct in implying that no sharp line can be drawn between this group and *Psychotria* proper. In the following treatment the species of the "*Calycodendron-Eumorphanthus*" alliance are discussed toward the end.

***Psychotria broweri* Seem. Fl. Vit. 135 (as *P. browerii*). 1866.**

VITI LEVU: Nandraonga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, alt. 725–825 m., *Smith* 5483 (A, US) (tree 4–5 m. high, in dense forest; fruit red).

The cited specimen is the only one of my 1947 collection that represents *P. broweri*, a species too broadly interpreted in herbaria. Seemann originally cited as representing this species his numbers 244 and 254, both from the island of Moturiki and both represented in the Gray Herbarium. The description agrees with no. 254, which Gillespie has indicated as an isotype. Number 244 represents a different species and has been so indicated by Gillespie; it has a single pedunculate inflorescence and small leaves.

Psychotria broweri is characterized by its glabrous foliage and infructescence; its leaves are narrowly elliptic, up to 25×9 cm., acute to attenuate at both ends. Its cymes are strictly sessile, with several (up to 6) short radiating branches, and its fruits are turbinate, up to 12 mm. long and sharply several-carinate when dried. My no. 172, from Kandavu, is also typical of this species, while my no. 1023 (from Koro) and *Gillespie* 3476 and *Degener* 15335 (both from Viti Levu) probably represent it. In herbaria, identifications of this species and of the related *P. brackenridgei* A. Gray, *P. turbinata* A. Gray, and *P. pritchardii* Seem. are often questionable. However, study of the types of these and of certain more recently described species will permit adequate circumscriptions.

***Psychotria brackenridgei* A. Gray in Proc. Am. Acad. 4: 44 (as *P. brackenridgii*). 1860.**

VITI LEVU: Mba: Northern slopes of Mt. Namendre, east of Mt. Koromba [Pickering Peak], *Smith* 4548; western and southern slopes of Mt. Tomanivi,

Smith 5137, 5266, 5305, 5748; N a n d r o n g a & N a v o s a : Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith* 5616.

The cited specimens (all A, US) are from shrubs or slender trees 2–5 m. high, occurring in dense forest at 725–1150 m. altitude, and all bear fruits that are at first pale green and eventually orange to red. These specimens may confidently be referred to Gray's concept, as represented by the type at the Gray Herbarium (no Exploring Expedition material of this species is in the U. S. National Herbarium). In foliage the species is very similar to *P. broweri* Seem., like which it has strictly sessile cymes. In comparison with Seemann's species, *P. brackenridgei* has a more ample inflorescence with persistently pilose branchlets and calyces. This species has been misidentified (by the writer and others) as *P. storckii* Seem. and *P. pritchardii* Seem.; older collections from Vanua Levu and Taveuni, as well as Viti Levu, fall into a reasonable concept of *P. brackenridgei*. Further study is needed to analyze the differences between this species and the very closely related *P. turbinata* A. Gray.

***Psychotria pritchardii* Seem. Fl. Vit. 135. 1866.**

VANUA LEVU: M a t h u a t a : Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, alt. 100–200 m., *Smith* 6744 (A, US) (slender tree 4 m. high, in patches of forest in open rolling country; corolla-bud white).

The cited collection is the only one of the species obtained by me in 1947. *Psychotria pritchardii*, as represented by *Seemann* 259 (isotype, Gray Herb.), from Taveuni, is readily characterized by its essentially glabrous habit, its large, fleshy, auriculate, subpersistent stipules, its lanceolate-elliptic leaves with blades up to 17×6 cm., its elongate inflorescence with a reflexed peduncle up to 18 cm. long, its slender pedicels 6–10 mm. long, and its shallowly undulate calyx-limb. Also representing the species are *Gillespie* 4826 and *Smith* 743, from Taveuni, and *Degener & Ordonez*, 13820, 14015, and 14097 and *Smith* 1606 and 1617, all from Vanua Levu. Certain specimens from Viti Levu so identified are in need of further study before they can be definitely referred here.

***Psychotria furcans* Fosberg in *Sargentia* 1: 133. 1942.**

VITI LEVU: M b a : Mt. Evans Range, *Smith* 4091, 4277, 4354, 4372; upper slopes of Mt. Koromba [Pickering Peak], *Smith* 4660, 4661; northern slopes of Mt. Namendre, east of Mt. Koromba, *Smith* 4550; slopes of the escarpment north of Nandarivatu, *Smith* 6038, 6270; N a n d r o n g a & N a v o s a : Northern portion of Rairaimatuku Plateau, *Smith* 5477, 5608.

The cited specimens (all A, US), collected in dense forest or hillside thickets at altitudes of 550–1075 m., were from shrubs or slender trees 2–10 m. high; the corolla is white or distally pale pink, and the fruit is red to bright orange. The species is typified by *Degener* 14450, from the Nandarivatu region, and Fosberg has questionably referred to it another specimen from lowland Vanua Levu. It now seems that *P. furcans* is one of the more abundant *Psychotriae* in upland Viti Levu, and I would also

refer here *Degener* 14369, 14625, and 14637, which were otherwise identified by Fosberg. The type is among the smaller-leaved specimens, but no differences of consequence are noted, except that the indument of the inflorescence is persistent to a varying degree. The petioles vary in length up to 7 cm., the leaf-blades may rarely be as large as 23×8 cm., and the peduncle, usually sharply reflexed, is up to 6 cm. in length. I doubt if this species is as closely related to my *P. edentata* and *P. pachyantha* as implied by Fosberg, and I should rather relate it to *P. pritchardii* Seem., from which stipular characters and the shorter inflorescence distinguish it. The forked stipules indicate a relationship of *P. furcans* to *P. broweri*, *P. brackenridgei*, and their more immediate relatives, from which the pedunculate inflorescence readily separates it.

***Psychotria chrysophylla* Fosberg in Bull. Torr. Bot. Cl. 67: 423. 1940.**

VITI LEVU: M b a : Slopes and summit of Mt. Ndelaiyoö, on the escarpment west of Nandarivatu, *Smith* 5078; southern slopes of Mt. Ndelainathovu, on same escarpment, *Smith* 4931; western and southern slopes of Mt. Tomanivi, *Smith* 5296; R a : Ridge from Mt. Namama (east of Nandarivatu) toward Mt. Tomanivi, *Smith* 5702; N a i t a s i r i : Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith* 6130; N a n d r o n g a & N a v o s a : Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith* 5545, 5593.

The cited specimens (all A, US) agree very closely with the original description, based only on the type, *St. John* 18344, collected in the upper Wainimala drainage near the center of Viti Levu. The type locality falls into the present Province of Naitasiri and lies about eight miles south of the last locality listed above. My specimens were from trees or shrubs 4–5 m. high, occurring in dense forest at elevations of 725–1150 m.; the corolla is pure white and in one case a fragrance of the flowers was noted. The only recorded local name (no. 5545) was *kau simbala*. Slightly to amplify the original description, it may be noted that the petioles vary in length from 0.5 to 3 cm., the leaf-blades are sometimes as much as 15 cm. long and 5.5 cm. broad, and the peduncle may be as long as 6 cm. The variation is no more than normal for a species of *Psychotria*, and in fact this is a very well-marked species, distinguished as originally noted by the uniform pubescence of the inflorescence and the rather regularly oblong leaf-blades which dry a characteristic yellow-green, at least on the upper surface.

***Psychotria st.-johnii* Fosberg in Bull. Torr. Bot. Cl. 67: 423. 1940.**

VITI LEVU: M b a : Slopes of Mt. Nairosa, eastern flank of Mt. Evans Range, *Smith* 4025, 4049; hills east of Nandala Creek, about 3 miles south of Nandarivatu, *Smith* 5927; hills between Nggalawana and Nandala Creeks, *Smith* 5839; hills between Nggalawana and Tumbeindreketi Creeks, *Smith* 5890, 5991; N a n d r o n g a & N a v o s a : Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith* 5648.

The cited specimens (all A, US) are from shrubs or slender trees 1–8 m. high, occurring in dense forest at elevations of 725–1050 m.; the calyx and corolla at anthesis are pure white and the fruit is red to bright orange. This material agrees very closely with the two specimens previously known of the species, both collected by St. John near the center of Viti Levu, about 10 miles south of the last locality listed above and in the present Province of Naitasiri. The species is very sharply marked by the short reddish indument of its long, calyptrate stipules and lower leaf-surfaces, by its acuminate, pale-nerved leaves, and by its white flowers with the calyx very inconspicuously lobed. Although the flowers are usually glabrous without, the reddish indument of the inflorescence-branches sometimes (as in my no. 5890) extends to the calyx-tube.

***Psychotria degeneri* Fosberg in Sargentia 1: 134. 1942.**

VITI LEVU: Mba : Western slopes of Mt. Nanggaranambuluta [Lomalangi], east of Nandarivatu, *Smith* 4771, 4773; western and southern slopes of Mt. Tomanivi [Mt. Victoria], *Smith* 5246, 5301; Nandronga & Navosa : Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith* 5540.

The cited specimens (all A, US) agree very well with the type and the three other collections originally cited; they were taken from shrubs or low trees 2–5 m. high, growing in dense forest at 725–1150 m. elevation. The inflorescences (branches, pedicels, calyx, and corolla) are white, or the pedicel and calyx may be faintly pink-tinged, and the fruit is red to orange. This recently described species, like *P. st.-johnii* (discussed above), proves to be fairly common in the undergrowth of the rain-forest of upland Viti Levu. It resembles *P. st.-johnii* in its strongly veined leaves and its delicate, sessile inflorescences, but it is most readily distinguished by its longer indument, which extends to the calyx and corolla, the individual hairs being reddish and several-celled.

***Psychotria diffusiflora* sp. nov.**

Arbor vel frutex ad 4 m. altus, praeter corollam et interdum costam foliorum ubique glaber, ramulis gracilibus teretibus apices versus ut petiolis luteo-glanduloso-lineolatis, internodiis distalibus 5–15 mm. longis; stipulis papyraceis maturitate 17–25 mm. longis in vaginam connatis superne in tubum brevem haud 1 mm. longum contractis, apice minute liberis recurvatis inconspicue bifidis, caducis, vagina ellipsoidea inflorescentiam juvenilem obtengente ad 12 mm. lata uno latere erumpente; petiolis leviter canaliculatis vel semiteretibus in sicco rugulosis 1–2 (–2.5) cm. longis, laminis foliorum papyraceis vel subcoriaceis copiose immerso-glanduloso-punctatis vel -lineolatis siccitate fusco-olivaceis, ellipticis vel elliptico-oblongatis, (6–) 7–12.5 cm. longis, (2.5–) 3–5 cm. latis, basi acutis et in petiolum manifeste decurrentibus, apice cuspidatis vel breviter acuminatis (apice ipso gracili 5–15 mm. longo callosus obtuso), margine integris vel undulatis leviter recurvatis, costa supra paullo elevata subtus prominente et interdum pilis rubellis multiseptatis circiter 1 mm. longis

patenti-pilosa, nervis secundariis utrinsecus 10–13 patentibus curvatis pallidis marginem versus inconspicue anastomosantibus supra prominulis vel subplanis subtus valde elevatis, rete venularum intricato utrinque subimmerso vel plano; inflorescentia terminali cymosa copiose ramulosa multiflora ad 10 cm. longa et lata epedunculata vel pedunculo ad 8 mm. longo, ramulis plerumque 5 divaricatis, pedunculis secundariis gracilibus ad 7 cm. longis, bracteis bracteolisque lanceolatis 0.5–2 mm. longis caducis, pedicellis gracilibus sub anthesi 7–9 mm. longis; calyce obconico-cupuliformi sub anthesi 1.5–2 mm. longo et apice diametro, tubo brevi, limbo suberecto membranaceo 0.5–0.8 mm. longo inconspicue nervato truncato vel obscure 5-denticulato; corolla membranacea infundibulari sub anthesi lobis inclusis 6–7 mm. longa faucibus pilis circiter 0.5 mm. longis copiose barbellatis exceptis glabra, tubo brevi haud 2 mm. longo, lobis 5 patentibus vel reflexis oblongis obtusis circiter 4 mm. longis et 1.5 mm. latis; staminibus 5 faucibus affixis exsertis, filamentis gracilibus circiter 3 mm. longis, antheris oblongis circiter 1.5 mm. longis; disco conspicuo annulari-pulvinato circiter 0.7 mm. alto; stylo gracili quam corolla brevior apice bifido; fructibus ovoideis circiter 7 mm. longis et 5 mm. latis, in sicco 4-angulatis et leviter complanatis, calycis limbo persistente coronatis, pyrenis hastatis circiter $6.5 \times 4.5 \times 2.5$ mm., basi obtusis, medium versus abrupte contractis, superne angustatis, ventre levibus, dorso basi levi excepto unicarinatis.

VITI LEVU: M b a : Southern slopes of Mt. Tomanivi [Mt. Victoria], alt. 850–1150 m., *Smith* 5247 (A, US) (tree 4 m. high, in dense forest; pedicel, calyx, and corolla pure white), 6087 (A TYPE, US) (Sept. 18, 1947; shrub 3 m. high, in dense forest; stipules greenish white; calyx and corolla white).

A representative of Gray's subgenus *Piptilema*, the new species is characterized by its glabrous habit, its large calyptrate stipules with very minute free portions, and its ample and many-flowered, spreading inflorescence. Its only close ally seems to be *P. filipes* A. Gray, from which it differs in its shorter petioles, in having its leaf-blades acute and decurrent at base (rather than narrowly but obviously cordate) and with more numerous secondary nerves, and in its long-pedicellate flowers, which are considerably larger, especially as to the corolla-lobes. My understanding of *P. filipes* is based entirely upon the type (US 62336), which was redescribed and discussed by Fosberg in *Sargentia* 1: 129. 1942.

***Psychotria tetragona* Seem. Fl. Vit. 137. 1866.**

VITI LEVU: M b a : Slopes and summit of Mt. Ndelaioö, on the escarpment west of Nandarivatu, alt. 900–1053 m., *Smith* 5057, 5058 (A, US).

The cited specimens agree very well with an isotype in the Gray Herbarium, *Seemann* 252, from Ovalau. The species is characterized by its glabrous habit, lanceolate leaves, forking stipules which are basally connate around the inflorescence-bud, very compact inflorescence, small calyx, conspicuous and pulvinate disk, and clavate corolla about 15 mm.

long. Also to be placed here are *Degener* 14611, 15057, and 15167 (all A, US), from Viti Levu.

Similar to *P. tetragona*, but differing in its broader leaf-blades (3–6 cm. broad) is *Smith* 4352 (A, US) (Viti Levu: Mba: Northern portion of Mt. Evans Range, between Mt. Vatuyanitu and Mt. Natondra, alt. 700–900 m.). My no. 4551 (A, US) (Viti Levu: Mba: Northern slopes of Mt. Namendre, east of Mt. Koromba, alt. 750–900 m.) is similar to no. 4352 except that the costa of the lower leaf-surface is copiously hispidulous with hairs 0.5–0.8 mm. long. In inflorescence characters these two specimens are hardly distinguishable from typical *P. tetragona*, and at present I am inclined to consider them extreme representatives of this species; it may be noted that both occur on isolated forested hills rising from the grassland of western Viti Levu.

Psychotria tetragonoides Fosberg, a species of this alliance somewhat suggested by the last two numbers discussed above, is clearly separable from *P. tetragona* by the indument of its foliage and flowers; it is not represented in my collection.

Psychotria ampullacea sp. nov.

Arbor gracilis ad 5 m. alta, ramulis subteretibus gracilibus praeter cicatrices stipularum hispidulas glabris, internodiis distalibus 6–10 mm. longis; stipulis glabris papyraceis 2–2.5 cm. longis in vaginam ampullaceam connatis, vagina basi ventricosa inflorescentiam juvenilem obtegentē superne in tubum circiter 1 cm. longum valde contracta, stipularum partibus liberis circiter 3 mm. longis bifidis; petiolis gracilibus glabris 1–3 cm. longis subteretibus rugulosis; foliorum laminis chartaceis in sicco fuscolivaceis, lanceolatis vel oblanceolatis, (9–) 12–17 cm. longis, (2–) 3.5–5 cm. latis, basi longe attenuatis et in petiolum decurrentibus, apice gradatim acuminatis, margine anguste recurvatis, supra glabris, subtus pilis 0.7–1 mm. longis rubellis multiseptatis copiose (demum sparsiore) patenti-pilosis, costa supra elevata subtus prominente, nervis secundariis utrinsecus 11–13 curvatis patentibus inconspicue anastomosantibus supra leviter subtus valde elevatis, rete venularum subimmerso; inflorescentia terminali subcapitata 9–12-flora, floribus pedicellatis, pedicellis teretibus 2–3 mm. longis copiose pilosis (pilis pallidis patentibus 0.5–0.7 mm. longis multiseptatis); calyce campanulato 8–9 mm. longo et apice circiter 4 mm. diametro, tubo brevi haud 1.5 mm. longo ut pedicello piloso, limbo erecto submembranaceo glabro conspicue nervato 5-lobato, lobis deltoideo-lanceolatis suberectis acutis 1–2 mm. longis; corolla submembranacea infundibulari sub anthesi circiter 20 mm. longa, extus lobis inclusis pilis ad 1 mm. longis ut pedicello copiose patenti-pilosa, intus glabra, lobis 5 erectis oblongis 4–5 mm. longis obtusis; staminibus glabris medium corollae versus insertis, filamentis gracilibus 4–5 mm. longis, antheris oblongis 2.5–2.8 mm. longis haud exsertis; disco conspicue pulvinato glabro circiter 1 mm. alto; stylo gracili glabro quam corolla brevior apice bifido.

VITI LEVU: Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, alt. 725–825 m., Aug. 11, 1947, *Smith 5659* (A TYPE, US) (slender tree 5 m. high, in dense forest; calyx pale green; corolla white).

The species here described, together with the following, seems superficially to be related to *P. tetragona* Seem. and *P. tetragonoides* Fosberg, because of its congested, subcapitate inflorescence. However, the calyces of the two older species are very small, scarcely 1.5 mm. in length, and inconspicuously dentate, whereas the calyces of the two species here described as new are comparatively elongate and obviously lobed. In texture, the calyx-limb of *P. ampullacea* suggests that of some of the species that have been referred to *Calycodendron*, but in those species the inflorescence is ample and freely branched. Probably these two new species belong in the general alliance of *P. tetragona*, but they seem to have no immediate relatives.

Further distinguishing characteristics of *P. ampullacea* are the indument of the leaves, pedicels, calyx-tube, and corolla (the hairs being divided into many short cells by transverse septae), and the form of the stipular sheath, which is flask-shaped, swollen at base to enclose the inflorescence-bud and narrowed to a very slender elongate throat, the stipules being free and bifid only at the extreme apices.

Psychotria tomaniviensis sp. nov.

Frutex ad 4 m. altus, ramulis gracilibus glabris subteretibus vel in sicco angulatis, internodiis distalibus 5–10 mm. longis; stipulis papyraceis 5–8 mm. longis basim versus connatis, superne 3–5 mm. liberis et profunde bifidis, glabris vel apicem versus puberulis; foliis glabris, petiolis canaliculatis 5–10 mm. longis vel subnullis, laminis chartaceis in sicco fusco-viridibus oblanceolatis, (7–) 10–16 cm. longis, (2.5–) 3.5–4.5 cm. latis, basi attenuatis et in petiolum longe decurrentibus, apice obtuse cuspidatis, margine integris et anguste recurvatis, costa supra subplana vel leviter elevata subtus prominente, nervis secundariis utrinsecus 12–15 curvatis patentibus inconspicue anastomosantibus supra subplanis subtus elevatis, rete venularum subimmerso; inflorescentia terminali subcapitata multiflora, bracteolis sub floribus lanceolatis circiter 2 mm. longis ciliolatis caducis, pedicellis teretibus circiter 1 mm. longis glabris; calyce campanulato sub anthesi circiter 10 mm. longo et apice 4 mm. diametro lobis interdum obscure puberulis exceptis glabro, tubo brevi haud 2 mm. longo, limbo erecto submembranaceo manifeste nervato 5-lobato, lobis oblongis 2–3 mm. longis subacutis; corolla submembranacea infundibulari sub anthesi circiter 22 mm. longa, extus glabra vel juventute pilis conicis haud 0.1 mm. longis minute puberula, intus medium versus pilis albidis mollibus copiose tomentella, lobis 5 erectis oblongis circiter 5 mm. longis obtusis; staminibus glabris, antheris subsessilibus apicem tubi corollae versus oblongis circiter 2 mm. longis; disco conspicue pulvinato glabro circiter 0.7 mm. alto; stylo gracili glabro leviter exserto apice bifido; fructibus subglobosis circiter

15 mm. diametro, pericarpio crasse carnosio, pyrenis obovoideo-oblongis circiter $8 \times 6 \times 5$ mm., ventre levibus, dorso superne conspicue 3-carinatis, apice profunde cavatis, basi rotundatis.

VITI LEVU: M b a : Western slopes of Mt. Tomanivi [Mt. Victoria], alt. 850–1150 m., July 17, 1947, *Smith 5294* (A TYPE, US) (shrub 3–4 m. high, in dense forest; calyx green; corolla pure white; fruit red).

The new species differs from the above described *P. ampullacea*, which seems to be its closest ally, in its much smaller stipules that do not form the flask-shaped sheath so noticeable in *P. ampullacea*, in its glabrous leaves and much shorter petioles, in its glabrous pedicels and calyx-tube, in having the external indument of the corolla composed of very minute conical hairs and evanescent, while within the corolla is tomentellous rather than glabrous, and in its subsessile anthers and elongate style. Such characters as length of filament and style, and perhaps internal pubescence of the corolla, may sometimes be correlated with actual or incipient dioecism in *Psychotria*.

Psychotria valleculata sp. nov.

Arbor ad 4 m. alta sub fructu cicatricibus stipularum obscure ferrugineo-setulosis exceptis ubique glabra, ramulis subteretibus crassis, internodiis longitudine diversis; stipulis subcoriaceis deltoideo-lanceolatis 6–7 mm. longis, basi connatis, superne liberis, apice integro minute mucronulatis; petiolis crassis rugulosis semiteretibus 8–18 mm. longis, laminis subcoriaceis in sicco pallide olivaceis, oblongo-obovatis, (6–) 8–10.5 cm. longis, (2.5–) 3.5–5 cm. latis, basi attenuatis et in petiolum longe decurrentibus, apice rotundatis, margine integris et anguste recurvatis, costa utrinque valde elevata, nervis secundariis utrinsecus 8–10 patentibus anastomosantibus utrinque elevatis, rete venularum subimmerso; inflorescentia non visa; infructescentia terminali capitata, receptaculo coriaceo rotundato vel clavato 2–4 mm. alto, fructibus 8–15 confertis radiatis subsessilibus, pedicellis haud 1 mm. longis vel subnullis; fructibus obovoideis in vivo ad 11 mm. longis et 8 mm. latis, in sicco indistincte 4-angulatis, calycis limbo mox caduco non viso, disco pulvinato interdum conspicuo circiter 1 mm. alto, pyrenis subhastato-ovoideis circiter $7 \times 4 \times 2$ mm., ventre complanatis vel basim versus inconspicue costatis, dorso conspicue unicarinatis, basi acutis, paullo supra medium valde contractis, apice rotundatis, parte basali obcordiformi carina excepta complanata, parte apicali conspicue angustiore.

VITI LEVU: N a n d r o n g a & N a v o s a : Southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, alt. 300–450 m., June 4, 1947, *Smith 4721* (A TYPE, US) (tree 4 m. high, in dense forest of valley; fruit red).

In spite of the lack of flowers, this collection seems patently to represent a new species, characterized by its oblong-obovate, rounded leaves and its strictly capitate infructescences. In the latter character and in its general

aspect the new species suggests *P. tetragona* Seem., but its stipules are of another type and its leaves are quite different; it is further characterized by its obovoid fruits, of which the pyrenes are unicarinate, sharply contracted near the middle, and broadly obcordiform in the basal part. It is perhaps referable to Gray's subgenus *Piptilema*, but it is only remotely related to the species of this group discussed by Fosberg (in *Sargentia* 1: 126. 1942).

***Psychotria evansensis* sp. nov.**

Arbor ad 5 m. alta vel frutex, ramulis crassis subteretibus novellis minute puberulis exceptis glabris, internodiis distalibus 1–3 cm. longis; stipulis papyraceis 3–5 mm. longis deltoideis obtusis, basi in vaginam brevem connatis, superne liberis, mox caducis; foliis magnis, petiolis semiteretibus 2–5.5 cm. longis primo minute puberulis demum glabratiss, laminis papyraceis in sicco fusco-viridibus anguste oblongis, 16–26 cm. longis, 5–8.5 cm. latis, basi attenuatis et in petiolum longe decurrentibus, in acuminem 1–2 cm. longum gradatim angustatis, margine integris vel undulatis anguste recurvatis, immerso-luteo-glandulosis, supra glabris, subtus minute puberulis glabratissque, costa supra subplana vel leviter elevata subtus prominente, nervis secundariis utrinsecus 12–18 curvatis patentibus anastomosantibus supra subplanis subtus elevatis, rete venularum intricato supra immerso subtus prominulo; inflorescentia non visa; infructescentia terminali cymosa fructibus inclusis 5–9 cm. diametro pedunculata, pedunculo gracili 2–4 cm. longo et ramulis primariis 4 vel 5 divaricatis 1–2.5 cm. longis pedicellisque minute puberulis, fructibus apices ramulorum versus pluribus, pedicellis gracilibus 1–3 mm. longis; fructibus in vivo obovoideis 11–12 mm. longis 9–10 mm. latis, in sicco valde 6–10-costatis, basi obtusis, apice rotundatis vel paullo depressis, calycis limbo persistente inconspicuo circiter 1 mm. longo submembranaceo fere ad basim 5-lobato lobis subacutis, pericarpio carnoso copiose immerso-luteo-glanduloso, pyrenis semi-obovoideis circiter $10 \times 7.5 \times 5$ mm., basi rotundatis, apice truncatis, ventre complanatis rugulosis basim versus costatis, dorso conspicue 3-carinatis, carinis crista rotundatis rugulosis, sulcis profundis, marginibus incrassatis interdum carinis similibus.

VITI LEVU: Mba : Slopes of Mt. Nairosa, eastern flank of Mt. Evans Range, alt. 700–1050 m., in dense forest, *Smith* 4024 (A, US) (shrub 3 m. high), 4072 (A TYPE, US) (Apr. 28, 1947; slender tree 5 m. high; fruit red).

Although it lacks flowers, the species here described is evidently a relative of *P. forsteriana* A. Gray, which it resembles in general appearance, leaf-shape and -texture, and the obovoid fruits with a very short calyx-limb, immersed-glandular pericarp, and 3-carinate pyrenes. The new species differs from *P. forsteriana* in its larger leaves, obviously pedunculate infructescences, and much larger fruits. The mature fruits of *P. forsteriana* are 6–7 mm. long and 5–6 mm. broad, while the pyrenes do not exceed $6 \times 5 \times 3.5$ mm. In the typical (Samoan) variety, the pyrenes are dorsally nearly smooth but somewhat rugulose with three incipient carinae, while

in var. *vitiense* A. Gray the pyrenes are obviously 3-carinate and marginally thickened so that they appear 5-carinate, the carinae being rounded and the sulcae deep, as in the new species.

While *P. evansensis* bears a resemblance to the common *P. carnea* (Forst. f.) A. C. Sm. in its foliage and in the size and shape of its mature fruits, the relationship is remote. *Psychotria carnea* has the persistent calyx-limb obvious, 3–6 mm. in length, and the pericarp only inconspicuously glandular. The pyrenes of *P. carnea* are fundamentally uncarinate, although the carina may be flattened on its crest or variously interrupted, while subsidiary protuberances may give the dorsal surface of the pyrene an irregularly rugulose appearance.

***Psychotria amoena* sp. nov.**

Arbor compacta vel gracilis ad 8 m. alta vel frutex, ramulis gracilibus teretibus glabris; stipulis papyraceis lanceolato-oblongis maturitate 8–11 mm. longis in vaginam spathaceam connatis, acuminatis, margine scariosis, extus glabris, intus pilis debilibus subadscendentibus 0.3–0.6 mm. longis pubescentibus, mox caducis, basibus pilosis interdum subpersistentibus; foliis glabris, petiolis gracilibus 0.5–2 cm. longis fere ad basim saepe anguste alatis, laminis papyraceis in sicco pallide viridibus, ovato-ellipticis vel lanceolatis, (2.5–) 3–5.5 cm. longis, (1–) 1.5–2.8 cm. latis, basi acutis vel attenuatis et in petiolum longe decurrentibus, apice cuspidatis et calloso-apiculatis, margine integris et anguste recurvatis, costa utrinque elevata, nervis secundariis utrinsecus 4–8 patentibus curvatis marginem versus anastomosantibus utrinque prominulis, rete venularum inconspicuo; inflorescentia terminali cymosa sub anthesi et fructu 2–4 cm. longa e basi 3-partita vel pedunculata, pedunculo raro ad 1 cm. longo, ramulis gracilibus ad 2.5 cm. longis glabris vel obscure puberulis; floribus praeter corollam intus glabris 3–10 apice ramulorum irregulariter aggregatis, pedicellis gracilibus sub anthesi 2–5 mm. sub fructu ad 9 mm. longis; calyce turbinato limbo incluso 2–2.5 mm. longo et apice diametro, limbo tenui suberecto 1–1.5 mm. longo inconspicue nervato integro vel obscure 5-denticulato; corolla subcarnosa breviter tubulosa vel campanulata sub anthesi 3–4 mm. longa, tubo brevi apice pilis pallidis circiter 0.5 mm. longis copiose barbellato, lobis 5 vel 6 oblongis circiter 2 mm. longis apice cucullatis sub anthesi reflexis; disco annulari-pulvinato circiter 0.5 mm. alto; staminibus 5 vel 6, filamentis gracilibus ad 0.5 mm. longis, antheris oblongis 0.8–1 mm. longis utroque obtusis; stylo quam corolla brevior in lobos complanatos profunde bifido; fructibus in vivo obovoideis in sicco inconspicue 6–10-costatis 7–8 mm. longis 6–7 mm. latis calycis limbo brevi persistente coronatis, pericarpio copiose immerso-luteo-glanduloso, pyrenis semi-obovoideis circiter $5.5 \times 4.5 \times 3$ mm., basi obtusis, apice rotundatis, ventre levibus, dorso 3-carinatis, carinis obtusis, sulcis brevibus, margine leviter incrassatis.

VITI LEVU: M b a : Slopes of Mt. Nairoso, eastern flank of Mt. Evans Range, alt. 700–1050 m., *Smith 4090* (A, US) (slender tree 8 m. high, in dense forest; corolla white; fruit deep red); hills east of Nandala Creek, about 3 miles south

of Nandarivatu, alt. 850–970 m., Sept. 9, 1947, *Smith 5949* (A TYPE, US) (compact tree 4 m. high, in mossy forest on ridge; calyx and disk pink-tinged; corolla, stamens, and style white; fruit green, at length dull orange); Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, alt. 725–825 m., between Nandrau and Rewasau, *Smith 5402* (A, US) (shrub 3 m. high, in dense forest; fruit becoming red), between Nandrau and Nanga, *Smith 5562* (A, US) (*ndengendenge*; compact tree 5 m. high, in dense forest; ripe fruit red). All the cited specimens are in fruit, and the first two bear flowers as well.

The close relationship of this graceful little plant to *P. forsteriana* A. Gray is shown by the similarity of their stipules, leaf-texture, fruits, and small flowers (with truncate calyx-limb and barbellate corolla-throat). However, the new species is more delicate in every respect, having leaves less than half as large and fewer-flowered inflorescences. Also of this general alliance is *P. setchellii* Gillespie, which, as compared with *P. amoena*, has the leaves longer and proportionately narrower, acuminate, and with more numerous secondaries, the inflorescence larger, and the corolla nearly twice as long.

Psychotria incompta sp. nov.

Arbor compacta ad 4 m. alta praeter calycis limbum sub fructu ubique glabra, ramulis rectis teretibus, internodiis distalibus plerumque 1–2.5 cm. longis; stipulis papyraceis 12–15 mm. longis primo in vaginam gracilem fere ad apices connatis, apicibus minutis simplicibus calloso-acutis, vagina mox irregulariter erumpente, basi breviter persistente; petiolis semiteretibus vel supra costatis gracilibus 0.5–2 cm. longis, laminis chartaceis vel subcoriaceis in sicco viridi-olivaceis, lanceolatis vel anguste ellipticis, 6–8.5 cm. longis, 2–3.5 cm. latis, basi attenuatis et in petiolum longe decurrentibus, apice cuspidatis vel in acuminem calloso-apiculatum ad 1 cm. longum gradatim angustatis, margine integris vel undulatis, costa supra elevata subtus prominente, nervis secundariis utrinsecus 8–10 patentibus curvatis anastomosantibus utrinque elevatis vel supra subplanis, rete venularum supra immerso subtus prominulo; inflorescentia desiderata; infructescentia terminali congesta simplici sessili, receptaculo parvo, pedunculis raro evolutis denique videtur 3-floris, pedicellis sub fructu gracilibus 6–15 mm. longis raro (apice pedunculi brevis binis) brevioribus basi bracteis evanescentibus subtentis; fructibus 4–9 per infructescentiam obovoideis maturitate ad 14 mm. longis et 8.5 mm. latis in vivo levibus in sicco obscure costatis, basi acutis, apice calycis limbo persistente coronatis, limbo papyraceo erecto 2.5–4 mm. longo utrinque obscure puberulo vel glabrato 4-lobato, lobis oblongis rotundatis 2–3 mm. longis, disco pulvinato carnosio, pericarpio crasse carnosio eglanduloso, pyrenis semi-obovoideis circiter $10 \times 6.5 \times 4$ mm., basi acutis, apice irregulariter truncatis, ventre levibus, dorso rotundatis et obscure unicarinatis, carina obtusa marginibus incrassatis simili.

VITI LEVU: Mba: Upper western slopes of Mt. Tomanivi [Mt. Victoria], alt. about 1200 m., July 10, 1947, *Smith 5208* (A TYPE, US) (compact tree 4 m. high, in dense mossy forest); summit of Mt. Nanggaranambuluta [Lomalangi],

east of Nandarivatu, alt. 1100–1120 m., *Smith 5672* (A, US) (compact tree 4 m. high, in dense forest).

Although flowers are not known for the species described above, its relationship to *P. carnea* (Forst. f.) A. C. Sm. and *P. archboldiana* Fosberg is indicated by the type of stipule, the leaf-texture, the large obovoid fruit with a conspicuous and persistent calyx-limb, and the shape of the pyrenes. From both of these species (§ *Eumachia*), however, *P. incompta* is readily distinguished by its simple inflorescence, the elongate pedicels being borne directly upon a small capitate receptacle. Rarely a short peduncle supports a pair of fruits, whereas in the two allied species the inflorescence is compound and obviously pedunculate. The new species further differs from *P. archboldiana* in its more robust habit, larger fruit, and dorsally comparatively smooth (rather than irregularly tuberculate) pyrenes, and from *P. carnea* in its narrower leaves and shorter calyx-limb.

***Psychotria leucocalyx* sp. nov.**

Arbor ad 4 m. alta praeter corollam intus pilosam ubique glabra, ramulis teretibus, novellis petiolisque luteo-glanduloso-lineolatis, internodiis distalibus plerumque 2–3.5 cm. longis, stipulis papyraceis 7–10 mm. longis inferne in vaginam tubulosam connatis, partibus liberis 3–6 mm. longis laminaribus profunde bilobatis; petiolis gracilibus semiteretibus 1.5–2.2 cm. longis, laminis subcoriaceis vel chartaceis in sicco fusco-olivaceis, oblongo-ellipticis, (8–) 12–17 cm. longis, (3–) 5–7.5 cm. latis, basi obtusis vel subacutis et in petiolum breviter decurrentibus, apice obtusis vel obtuse cuspidatis, margine integris et anguste recurvatis, utrinque immerso-luteo-lineolatis, costa supra leviter elevata et sulcata subtus prominente, nervis secundariis utrinsecus 12–14 patentibus curvatis marginem versus anastomosantibus supra paullo subtus valde elevatis, rete venularum intricato subimmerso vel utrinque subprominulo; inflorescentia terminali pedunculata 3–4-plo divisa sub anthesi ad 13 cm. longa, pedunculo subtereti crasso 3.5–4.5 cm. longo, ramulis 4 vel 5, pedunculis secundariis 2–3 cm. longis; bracteis sub ramulis submembranaceis glabris obovatis ad 10 mm. longis in lobos lanceolatos 3–5 acutos profunde fassis, bracteolis similibus, ultimis circiter 2 mm. longis, omnino caducis; pedicellis gracilibus sub anthesi 4–7 mm. longis; calyce magno, tubo turbinato sub anthesi 1.5–2 mm. longo et circiter 3 mm. diametro apice contracto, limbo membranaceo conspicue reticulato-nervoso breviter adscendente deinde patente subrotato 15–17 mm. diametro profunde 4- vel 5-lobato, lobis oblongo-deltoides ad 7 mm. longis latisque obtusis margine undulatis; corolla tenuiter carnosae tubulosa sub anthesi 23–30 mm. longa et medium versus circiter 3 mm. diametro superne paullo ampliata, extus glabra, intus omnino copiose puberula etiam medium versus pilis pallidis ad 1 mm. longis molliter tomentella, lobis 4 vel 5 oblongis 3–5 mm. longis suberectis vel demum reflexis apice rotundatis et cucullatis; staminibus 4 vel 5 faucibus affixis, antheris subsessilibus oblongis circiter 3.5 mm. longis basi sagittatis apice obtusis; disco conspicuo hemisphaerico-pulvinato circiter 0.8 mm. alto, stylo

filiformi leviter exserto, stigmatis lobis complanatis; fructibus juvenilibus turbinatis in sicco leviter costatis, calycis limbo mox caduco.

VITI LEVU: Naitasiri: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi [Mt. Victoria] and Nasonggo, alt. 870–970 m., Sept. 18, 1947, *Smith 6103* (A TYPE, US) (tree 4 m. high, in dense forest; calyx and corolla white).

This striking species, characterized by its large, spreading, membranaceous calyx-limb, is closely allied only to *P. magnifica* (Gillespie) Fosberg, from which it differs in having its leaf-blades proportionately slightly broader and predominantly obtuse at base and in having its inflorescence glabrous except for the inner surface of the corolla. *Psychotria magnifica* has the inflorescence-branches, pedicels, calyx-tube (and base of limb), and outer surface of corolla copiously puberulent. Other species of this immediate relationship, *P. glabra* (Turrill) Fosberg and *P. fragrans* (Gillespie) Fosberg, differ from *P. leucocalyx* more sharply, the first in its elongate calyx-tube and even larger calyx-limb and corolla, the second in its smaller leaves, comparatively small and conspicuously glandular-linear calyx, and hispidulous corolla.

Psychotria jugalis sp. nov.

Arbor compacta ad 4 m. alta, ramulis crassis teretibus glabris, nodis distalibus plerumque 1–2 cm. longis obscure luteo-glanduloso-lineolatis; stipulis papyraceis 10–15 mm. longis dorso pilis rubellis 0.5–1 mm. longis furfuraceo-setosis, inferne in vaginam cupuliformem 4–5 mm. longam connatis, partibus liberis oblongis in segmentos 2 deltoideos acutos profunde bifidis; foliis glabris, petiolis crassis semiteretibus 1.5–3 cm. longis, laminis subcoriaceis in sicco fusco-olivaceis oblongo-ellipticis, (8–) 11–15 cm. longis, (3.5–) 5–7 cm. latis, basi acutis et in petiolum decurrentibus, apice cuspidatis et calloso-obtusis, margine integris et anguste recurvatis, costa supra valde elevata subtus prominente, nervis secundariis utrinsecus 10–13 patentibus leviter curvatis marginem versus anastomosantibus supra subplanis subtus elevatis, rete venularum subimmerso; inflorescentia terminali sub anthesi ad 9 cm. longa pedunculata multiflora plerumque 3-plo divisa bracteis bracteolisque et corolla exceptis glabra, pedunculo crasso tereti 2.5–3 cm. longo, ramulis 4 vel 5 patentibus, pedunculis secundariis ad 3 cm. longis; bracteis sub ramulis papyraceis lanceolatis 7–10 mm. longis ut stipulis dorso copiose rufo-pilosis (pilis 0.2–0.5 mm. longis), profunde 3–5-lobatis, lobo medio elongato acuto, caducis, cicatricibus pilis rufidis copiosis ornatis, bracteolis similibus, ultimis 1–3 mm. longis; pedicellis teretibus paullo ante anthesin circiter 4 mm. longis; calyce magno, tubo turbinato 1.5–2 mm. longo et circiter 3 mm. diametro, limbo membranaceo conspicue reticulato-nervoso breviter adscendente deinde patente subrotato 10–12 mm. diametro profunde 5-lobato, lobis oblongo-delloideis ad 3 mm. longis et 4 mm. latis obtusis; corolla carnosula tubulosa ante anthesin ad 13 mm. longa et medium versus circiter 3 mm. diametro superne paullo ampliata, extus marginibus loborum leviter pilosis exceptis

glabra, intus inferne glabra medium versus pilis pallidis circiter 1 mm. longis copiose molliter induta, lobis 5 oblongis in alabastro circiter 2.5 mm. longis intus puberulis apice rotundatis et cucullatis; staminibus 5 faucibus affixis, antheris subsessilibus oblongis circiter 3 mm. longis basi sagittatis apice obtusis; disco hemisphaerico-pulvinato circiter 0.6 mm. alto; stylo tereti in alabastro quam corolla brevior, stigmatibus lobis complanatis.

VITI LEVU: Mba : Ridge between Mt. Nanggaranambuluta [Lomalangi] and Mt. Namama, east of Nandarivatu, alt. 1050–1120 m., Aug. 18, 1947, *Smith 5681* (A TYPE, US) (compact tree 4 m. high, in dense forest; calyx white).

The species here described is evidently closely related to the preceding (*P. leucocalyx*), like which it has a membranaceous, subrotate calyx-limb and an externally glabrous corolla. It differs from *P. leucocalyx* in its copiously reddish-pilose stipules, bracts, and bracteoles, in its smaller calyx, and presumably in having its inflorescence more compact, although *P. jugalis* is not known at full anthesis.

Psychotria gibbsiae S. Moore in Jour. Linn. Soc. Bot. 39: 152. 1909.

VITI LEVU: Mba : Slopes and summit of Mt. Ndelaioö, on the escarpment west of Nandarivatu, alt. 900–1053 m., *Smith 5068* (A, US) (freely branching tree 5 m. high, in dense forest; calyx-limb and corolla white).

Among the specimens of this relationship available to me, the cited number is the only one that appears in every respect to agree with Moore's description. The original collections, *Gibbs 664* and *734*, came from "Nandarivatu, 2700 [ft.], edge of N. W. escarpment," which may be the precise locality of my no. *5068*. Mt. Ndelaioö is one of the eminences surmounting the escarpment west of Nandarivatu, and an old trail from Nandarivatu toward Mba passes near it; consequently it is a locality almost certainly visited by Gibbs. The species, as I interpret it, is characterized not only by its small leaves and compact cymes, but by the close and uniform puberulence of its inflorescence (including branches, pedicels, bracts, bracteoles, calyx, and corolla, the hairs being very dense and 0.1–0.2 mm. long), by having its campanulate (not subrotate) calyx-limb about 8 mm. long, and by having its puberulent stipules connate below into a campanulate (not tubular) base 3–5 mm. long, the free portions being about 5 mm. long and deeply bifid into lanceolate lobes.

Psychotria nandarivatensis sp. nov.

Arbor ad 4 m. alta, ramulis subteretibus, novellis et petiolis interdum patenti-pilosis (pilis rubellis ad 0.3 mm. longis) mox glabris, nodis distalibus plerumque 5–15 mm. longis; stipulis papyraceis glabris 10–18 mm. longis glandulis minutis luteis linearibus copiose ornatis in vaginam tubulosam vel ampulliformem connatis, partibus liberis 2–3 mm. longis profunde bifidis; petiolis semiteretibus 1–2 cm. longis, laminis subcoriaceis in sicco olivaceis, lanceolatis vel anguste ellipticis, (5–) 7–13 cm. longis, (2–) 3–5.5 cm. latis, basi attenuatis et in petiolum decurrentibus, apice subacutis vel obtuse callosis-cuspidatis, margine integris et anguste recurva-

tis, supra glabris, subtus pilis rubellis multiseptatis fastigantibus 0.5–1 mm. longis patentibus ornatis demum glabratiss, costa supra elevata subtus prominente, nervis secundariis utrinsecus 9–12 erecto-patentibus marginem versus leviter curvatis et anastomosantibus supra subplanis subtus elevatis vel prominulis, rete venularum immerso; inflorescentia compacta cymosa epedunculata pauciflora simplici (floribus receptaculo parvo enatis) vel e basi inconspicue 3-ramulosa raro 2-plo divisa, ramulis brevibus ut pedicellis patenti-pilosis (pilis multiseptatis rufidis 0.3–0.7 mm. longis) vel mox glabratiss; bracteolis membranaceis deltoideis vel lanceolatis 1–4 mm. longis saepe irregulariter pauci-fissis, margine ciliolato excepto glabris, lobis callosis-apiculatis; pedicellis teretibus sub anthesi 8–14 mm. longis raro longioribus; calyce campanulato sub anthesi circiter 12 mm. longo et 10 mm. diametro ut pedicellis extus piloso vel glabrato vel glabro, tubo inconspicuo sub anthesi haud 1.5 mm. longo superne non contracto, limbo papyraceo in 5–6 mm. basalibus erecto tubuloso 3–4 mm. diametro deinde patente, lobis 5 oblongis 3–5 mm. longis 4–5 mm. latis manifeste nervatis apice obtusis; corolla submembranacea infundibulari sub anthesi lobis inclusis 17–20 mm. longa et basim versus circiter 2 mm. diametro superne ampliata, primo ut calyce extus copiose pilosa (pilis pallidioribus ad 1 mm. longis) inferne saepe subglabrata, tubo intus supra medium similiter piloso, lobis 5 oblongis circiter 4×2 mm. apice rotundatis demum reflexis; staminibus 5 in faucibus affixis, filamentis glabris brevibus, antheris oblongis circiter 2.5 mm. longis apice obtusis, loculis basi saepe divergentibus; disco conspicuo hemisphaerico-pulvinato circiter 1.5 mm. alto luteo-glanduloso-lineolato; stylo filiformi, stigmatibus lobis complanatis.

VITI LEVU: Mba: Immediate vicinity of Nandarivatu, alt. 800–900 m.. *Smith 5031* (A TYPE, US) (July 2, 1947; tree 4 m. high, in dense forest along stream; corolla white), *Degener & Ordenez 13598* (A, US, etc.) (tree, in rain-forest); western slopes of Mt. Nanggaranambuluta [Lomalangi], east of Nandarivatu, alt. 850–1000 m., *Smith 6303* (A, US) (compact tree 4 m. high in dense forest).

The new species differs from its closest ally, *P. gibbsiae* S. Moore (discussed above), in having its stipules connate into a tubular or flask-shaped sheath, with the free tips comparatively minute, in having its inflorescence-branches, pedicels, and calyx spreading-pilose with comparatively long, reddish, multiseptate hairs (or glabrate, but not closely puberulent), in having its bracteoles glabrous except for the ciliolate margins, and in having its calyx campanulate from the base, whereas in *P. gibbsiae* it is slightly contracted at the apex of the tube and then flaring slightly into the campanulate limb. It should be noticed that no. 6303, identical with no. 5031 in every other respect, has its calyx glabrous, indicating that the degree of indument is not as dependable as its type.

Psychotria vaughanii sp. nov.

Frutex, ramulis crassis teretibus apicem versus pilis haud 0.1 mm. longis copiose sed minute cinereo-puberulis, nodis distalibus 1–3 cm. longis; stipulis papyraceis 3–4 mm. longis (immaturis?) dorso parce puberulis

inferne in vaginam brevem connatis, partibus liberis circiter 2 mm. longis bifidis; petiolis crassis semiteretibus 0.7–1.4 cm. longis ut ramulis juvenilibus dense puberulis, laminis coriaceis in sicco luteo-viridibus, oblanceolatis vel anguste ellipticis, 12–19 cm. longis, 4–7 cm. latis, basi acutis et in petiolum decurrentibus, apice obtuse cuspidatis, margine undulatis et anguste recurvatis, supra glabris, subtus minute sed copiose puberulis, costa valida supra leviter elevata et obscure sulcata subtus prominente, nervis secundariis utrinsecus 12–14 patentibus curvatis marginem versus obscure anastomosantibus utrinque inconspicue elevatis, rete venularum immerso; inflorescentia terminali epedunculata e basi 3-ramulosa multiflora plerumque 4-plo divisa, ramulis pedicellisque copiose puberulis (pilis fulvis circiter 0.1 mm. longis), bracteolis papyraceis lanceolatis ad 1 mm. longis margine ciliolato et irregulariter fisso excepto glabris caducis; floribus e nodis ultimis plerumque 3, pedicellis gracilibus sub anthesi 3–5 mm. longis; calyce sub anthesi circiter 5 mm. longo et apice diametro extus copiose puberulo vel superne demum glabrato, tubo minuto cupuliformi, limbo campanulato inferne erecto breviter tubuloso circiter 3 mm. diametro apice subito patente, lobis 5 deltoideis rotundatis circiter 1.5×2 mm.; corolla submembranacea infundibulari sub anthesi 11–12 mm. longa et basim versus circiter 1.5 mm. diametro superne ampliata, extus inconspicue sed copiose puberula, intus inferne glabra medium versus pilis pallidis circiter 0.5 mm. longis copiose tomentella superne puberula, lobis 5 erectis oblongis circiter 1.5 mm. longis apice rotundatis et cucullatis; staminibus 5 apicem tubi corollae versus insertis glabris, filamentis gracilibus circiter 1 mm. longis, antheris oblongis circiter 2 mm. longis; disco pulvinato circiter 0.6 mm. alto; stylo gracili quam corolla brevior, stigmatibus lobis complanatis.

VITI LEVU: Naitasiri: Prince's Road, mile 7 [approximate vicinity of Tholo-i-suva], alt. about 150 m., Nov. 10, 1946, *J. H. Vaughan 3323* (TYPE in herbarium of British Museum) (common shrub, with terminal clusters of tubular white flowers).

The species here described suggests *P. fragrans* (Gillespie) Fosberg in the size and spreading apex of its calyx-limb. However, the calyx-limb of *P. fragrans* is subrotate from its base, rather than campanulate, and is conspicuously glandular-lineate, while the plant is essentially glabrous in habit, has comparatively small leaves, a pedunculate inflorescence, and a longer corolla. Actually *P. vaughanii* in calycine characters more nearly approximates *P. gibbsiae* S. Moore, a species with much smaller leaves and a more compact and fewer-flowered inflorescence. The new species is further distinguished by the uniform puberulence of its vegetative parts and inflorescence and by having its narrowly campanulate calyx-limb flaring only at the apex.

Psychotria mundula sp. nov.

Frutex ad 2 m. altus ubique praeter corollam glaber vel partibus novellis minute puberulis, ramulis gracilibus teretibus in sicco rugulosis, internodiis

distalibus 2–6 mm. longis; stipulis papyraceis ovato-oblongis 3.5–6 mm. longis in vaginam inferne connatis, superne liberis saepe scarioso-marginatis, dorso brevi-calcaratis vel in apicem subacutum vel acuminatum interdum puberulum productis; foliis apices ramulorum versus confertis parvis, petiolis gracilibus semiteretibus 2–7 mm. longis, laminis subcoriaceis obscure immerso-glandulosis in sicco viridi-olivaceis, lanceolatis vel ellipticis, (2–) 3–5.5 cm. longis, (0.5–) 1–2 cm. latis, basi attenuatis et in petiolum decurrentibus, apice acutis vel breviter acuminatis et callosopapiculatis, margine integris anguste recurvatis, costa supra subplana subtus elevata, nervis secundariis utrinsecus 7–10 inconspicuis patentibus vel subadscendentibus curvatis anastomosantibus supra planis subtus prominulis, rete venularum immerso; inflorescentia terminali cymosa compacta pauciflora epedunculata vel pedunculo ad 2 mm. longo, sub anthesi floribus inclusis 2–3 mm. longa, ramulis plerumque 3 patentibus ad 1.5 cm. longis saepe 3-floris, floribus sessilibus, lateralibus apice ramulorum secundariorum ortis, bracteolis sub floribus 1–2 mm. longis deltoideis acutis vel interdum apice trifidis; calyce infundibulari sub anthesi limbo incluso 5–7 mm. longo et apice 3–4 mm. diametro, tubo brevi, limbo papyraceo erecto lobis inclusis 3–4 mm. longo, lobis 5 vel 6 deltoideo-lanceolatis 1–1.5 mm. longis incrassatis acutis interdum apice patentibus; corolla tenuiter carnosa gracili infundibulari sub anthesi lobis inclusis 13–15 mm. longa, extus glabra, intus faucibus et lobis pallide puberula, lobis 5 vel 6 oblongis obtusis 3–4 mm. longis sub anthesi patentibus; staminibus 5 vel 6, filamentis gracilibus ad 1 mm. longis vel subnullis, antheris oblongis 2–2.3 mm. longis utroque obtusis; disco annulari-pulvinato 0.6–0.8 mm. alto; stylo filiformi interdum corollam subaequante, apice bifido.

VANUA LEVU: *Mathuata*: Northwestern slopes of Mt. Numbuloa, east of Lambasa, alt. 500–590 m. [also noted on summit], Nov. 6, 1947, *Smith 6533* (A TYPE, US) (shrub 2 m. high, in wind-swept thickets; corolla white). VITI LEVU: *Mba*: Mountains near Lautoka, alt. 480–550 m., *Greenwood 1226, 1227, 1270, 1271* (all US) (shrubs about 50 cm. high, on dry open hillsides; flowers white).

The very distinct species described above is characterized by its compact habit, the crowded leaves nearly concealing the small, few-flowered inflorescences. Each branch of the 3-parted inflorescence usually bears three sessile flowers, but the lateral flowers, borne on short secondary branchlets, are sometimes flanked by additional and mostly undeveloped flowers. The erect calyx-limb, with longitudinal thickenings terminating in the lobes, and the slender corolla with the throat puberulent also characterize the species. In its basic floral characters, the new species seems most closely related to *P. gillespieana* A. C. Sm. [*Calycosia laxiflora* Gillespie] (represented in my present collection by nos. 5180 and 5184, from Mt. Tomanivi, the type-locality), a species with much larger stipules which have laminar forked apices, larger and longer-petiolate leaves, a much more ample and freely divided inflorescence, and larger flowers. Greenwood's specimens were taken from two plants, his nos. 1227 and 1270

representing one and nos. 1226 and 1271 the other, the second of these having slightly the narrower leaves.

***Psychotria leptocalyx* sp. nov.**

Arbor ad 5 m. alta, ramulis gracilibus subteretibus et petiolis minute sed dense puberulis (pilis griseis ad 0.05 mm. longis), internodiis distalibus 8–15 mm. longis; stipulis papyraceis 15–17 mm. longis extus copiose puberulis, basim versus in vaginam connatis, partibus liberis laminaribus 10–12 mm. longis conspicue bifidis; petiolis gracilibus semiteretibus 1–2 cm. longis, laminis subcoriaceis in sicco fuscis, oblanceolatis vel elliptico-obovatis, 9–16 cm. longis, 3–6.5 cm. latis, basi attenuatis et in petiolum longe decurrentibus, apice obtusis vel obtuse cuspidatis, margine integris et anguste recurvatis, supra glabris, subtus minute sed uniformiter griseo-puberulis, costa supra leviter elevata et sulcata subtus prominente, nervis secundariis utrinsecus 11–13 arcuato-adscentibus marginem versus anastomosantibus supra paullo subtus valde elevatis, rete venularum immerso; inflorescentia terminali sub anthesi ad 12 cm. longa multiflora plerumque 4-plo divisa manifeste pedunculata, pedunculo gracili ad 4 cm. longo et ramulis inflorescentiae pedicellisque copiose puberulis, pedunculis secundariis 3 radiatis 2–3.5 cm. longis; bracteolis papyraceis oblongis 1–1.5 mm. longis in lobos 3 plerumque fassis, dorso puberulis, margine ciliolatis, bracteis similibus 3–4 mm. longis mox glabris et caducis; pedicellis sub anthesi gracilibus ad 6 mm. longis; calyce sub anthesi 6–7 mm. longo et apice 4–5 mm. diametro extus copiose puberulo, tubo pyriformi circiter 1.5 mm. longo et 2.5 mm. diametro, apice constricto, limbo papyraceo obscure nervato, parte basali fusiformi erecta 3–4 mm. longa et circiter 2.5 mm. diametro superne leviter contracta deinde subito patente, lobis 5 oblongis rotundatis circiter 1.5×2 mm.; corolla submembranacea infundibulari circiter 20 mm. longa (vel ultra?) et basim versus 2 mm. diametro superne ampliata, extus basi excepta cinereo-puberula, intus medium versus pilis ad 0.6 mm. longis dense tomentella, lobis 5 erectis oblongis 3–4 mm. longis apice obtusis cucullatis; staminibus 5 faucibus affixis glabris, filamentis gracilibus 1–2 mm. longis, antheris oblongis circiter 3 mm. longis; disco pulvinato circiter 0.5 mm. alto; stylo gracili quam corolla brevior, stigmatibus lobis complanatis.

VITI LEVU: Mba: Hills east of Nandala Creek, about 3 miles south of Nandarivatu, alt. 850–970 m., Sept. 25, 1947, *Smith 6215* (A TYPE, US) (tree 5 m. high, in dense forest; pedicel and calyx-tube greenish white, the lobes white; corolla white).

In its comparatively narrow, fusiform calyx-limb, *P. leptocalyx* suggests *P. vitiensis* Fosberg [*Calycosia monticola* Gillespie], which, as Fosberg has pointed out (in *Sargentia* 1: 127. 1942), is distinct from *P. calycosa* A. Gray. From *P. vitiensis*, however, the new species is readily distinguished by the dense, although minute, puberulence of its vegetative and inflorescence parts, and by its larger leaves and more freely branching inflorescence. Also suggestive of the new species and resembling it in indument is *P.*

vaughanii, described above, which has the inflorescence epedunculate, the calyx proportionately broader, with the basal part of the limb campanulate rather than fusiform, and the corolla apparently shorter.

***Psychotria eumorphanthus* Fosberg in Sargentia 1: 127. 1942.**

VITI LEVU: M b a : Western slopes of Mt. Tomanivi [Mt. Victoria], alt. 850–1000 m., *Smith 5091* (A, US) (tree 6 m. high, in dense forest; calyx-limb green).

This species (*Eumorphanthus fragrans* A. C. Sm. in Bishop Mus. Bull. 141: 158. fig. 81. 1936) has previously been known only from the type collection, from Taveuni. The cited Viti Levu specimen, in fruit, agrees in all respects with the type and similarly has a subpersistent calyx-limb about 2 cm. long; the only apparent difference is that no. 5091 has the secondary nerves of the leaves slightly closer, 12–15 per side rather than 9–13. Unless the discovery of flowers should prove otherwise, I think that the range of the species may safely be extended to include Viti Levu.

***Psychotria leptantha* sp. nov.**

Arbor ad 12 m. alta, ramulis gracilibus subteretibus glabris (vel novellis interdum parce puberulis) apices versus 1.5–2 mm. diametro, internodiis distalibus 5–10 mm. longis; stipulis lanceolatis 6–8 mm. longis obscure puberulis vel glabris, basim versus lateraliter cohaerentibus, apice subacutis, mox caducis; foliis patentibus glabris, petiolis semiteretibus gracilibus 1–3 cm. longis, laminis papyraceis in sicco viridibus, interdum ut ramulis stipulisque cystolithis circiter 0.2 mm. longis ornatis, ellipticis vel oblanceolatis, 7–12 cm. longis, 3–5 cm. latis, basi acutis vel attenuatis et in petiolum decurrentibus, apice cuspidatis (apice ipso ad 5 mm. longo obtuso vel subacuto), margine integris, costa supra leviter elevata et basim versus anguste canaliculata subtus prominente, nervis secundariis utrinsecus 6–9 arcuato-patentibus marginem versus anastomosantibus supra subplanis subtus elevatis, rete venularum laxo utrinque prominulo vel supra immerso; inflorescentia terminali pauciflora compacte cymosa sub anthesi corolla inclusa ad 9 cm. longa et lata plerumque e basi 3-partita bracteis pluribus deltoideis obtusis 2–3 mm. longis caducis subtenta, ramulis gracilibus laxe pilosis (pilis pallidis 0.1–0.3 mm. longis obscure pluriseptatis), lateralibus 1–1.5 cm. longis apice 2- vel 3-floris, ramulo centrali semel vel bis partito plurifloro; bracteis sub floribus minutis circiter 1 mm. longis caducis, pedicellis teretibus sub anthesi 5–9 mm. longis ut ramulis pilosis in calycem gradatim crassatis; calyce graciliter infundibulari sub anthesi 1.5–2 cm. longo basim versus piloso vel puberulo alioqui glabro, tubo minuto, limbo magno erecto submembranaceo conspicue longitudinaliter nervato apice circiter 5 mm. diametro inconspicue 5-lobato, lobis inaequalibus deltoideis acutis haud 1 mm. longis; corolla hypocrateriformi submembranacea, tubo graciliter cylindrico sub anthesi 3.5–4 cm. longo et circiter 1.5 mm. diametro faucibus paullo ampliato superne extus puberulo et intus subtiliter arachnoideo-tomentello cetera glabro, lobis 5 patentibus anguste oblongis vel obovatis 13–15 mm. longis circiter 4 mm. latis mani-

feste nervatis apice obtusis extus puberulis intus glabris; staminibus 5 tubi apicem versus insertis et leviter exsertis, filamentis membranaceis ligulatis ad 5 mm. longis vel omnino tubum adnatis, antheris anguste oblongis circiter 3.5 mm. longis obtusis; disco annulari-pulvinato glabro circiter 0.8 mm. alto et 1.5 mm. diametro; stylo gracili glabro circiter 2 cm. longo in stigmata circiter 2 mm. longa fisso; floribus post anthesin saepe caducis, fructibus 1 vel 2 per inflorescentiam, pedicellis sub fructu 1–1.5 cm. longis persistenter patenti-pilosis; fructibus in vivo carnosus et ellipsoideis ad 23×15 mm. (maturis?) in sicco 4-angularibus, basim versus et basi persistente calycis limbi puberulis, parte majore calycis limbi mox caduca, pyrenis (maturis?) triquetro-ovoideis circiter 1 cm. longis latisque, basi rotundatis, apice subacutis, ventre complanatis levibus, dorso unicarinatis.

VITI LEVU: M b a : Slopes of Mt. Nairoso, eastern flank of Mt. Evans Range, alt. 700–1050 m., in dense forest, *Smith* 4048 (A TYPE, US) (April 26, 1947; tree 8 m. high; calyx and corolla pure white), 4423 (A, US) (tree 12 m. high, in fruit).

Psychotria leptantha is a sharply marked and very attractive species, characterized by its long, narrow calyx-limb and its very slender, elongate corolla-tube. It is closely allied only to *P. eumorphanthus* Fosberg, from which it obviously differs in being more delicate and slender throughout, in its much smaller leaves, slightly smaller and more slender calyx-limb, corolla with a slightly shorter tube and much smaller lobes, and shorter style. Fosberg (in *Sargentia* 1: 125, 127. 1942), in reducing my genus *Eumorphanthus* to *Psychotria*, allies its single species to *P. confertiflora* A. C. Sm. [*P. umbraticola* Gillespie]. This is perhaps the correct disposition, since the two species concerned are quite similar in basic corolla and fruit characters. However, the calyx-limb of *P. confertiflora* does not exceed 7 mm. in length, whereas in both *P. eumorphanthus* and *P. leptantha* it approaches or exceeds 2 cm. *Psychotria confertiflora* proves to be a very common species in upland Viti Levu, being represented in my present collection by nos. 4542, 4800, 5011, 5129, 5252, 5313, 5560, and 5790, and also by *Degener* 13567, 14280, 14610, 14754, and 14830. To the Vanua Levu specimens cited by me as *P. confertiflora* (in *Bishop Mus. Bull.* 141: 152. 1936) may be added *Smith* 6470, 6650, and *Degener & Ordonez* 14010.

Psychotria gracilior sp. nov.

Arbor ad 10 m. alta sub fructu ubique glabra, partibus novellis, stipulis, petiolis inflorescentiae ramulisque cystolithis 0.1–0.3 mm. longis saepe copiose ornatis; ramulis gracilibus subteretibus apices versus 1.5–2 mm. diametro, internodiis distalibus 5–7 mm. longis; stipulis lanceolatis 1–1.5 cm. longis infra medium lateraliter connatis apice liberis et calloso-acuminatis mox caducis; foliis patentibus, petiolis gracilibus semiteretibus 1–2 cm. longis, laminis papyraceis in sicco viridibus oblanceolatis, 8–11 cm. longis, 2.5–4 cm. latis, basi attenuatis et in petiolum longe decurrentibus, apice in acuminem gracilem 5–10 mm. longum obtusum angustatis, margine

integris et leviter recurvatis, supra cystolithis dispersim ornatis, costa supra leviter elevata subtus prominente, nervis secundariis utrinsecus 7-9 marginem versus obscure anastomosantibus supra subplanis subtus elevatis, rete venularum laxo supra plano subtus prominulo; infructescentia terminali compacte cymosa fructibus inclusis ad 4 cm. longa et 6 cm. lata e basi 3-partita bracteis caducis subtenta, ramulis lateralibus (interdum caducis cicatricibus indicatis) 8-12 mm. longis fructus 2 vel 3 gerentibus, ramulo centrali plerumque semel partito; fructibus pluribus per infructescentiam, pedicellis gracilibus 6-12 mm. longis, fructibus in vivo carnosus ellipsoideis maturitate ad 2×1.5 cm. in sicco 4-angularibus, utroque obtusis vel subacutis, calycis limbo subpersistente cylindrico papyraceo erecto 4-5 mm. longo longitudinaliter nervato coronatis, limbo apice irregulariter erosulo vel inconspicue 5-lobato, lobis deltoideis obtusis circiter 0.5 mm. longis; pyrenis triquetro-oblongo-ellipsoideis, 11-12 mm. longis, 6.5-8 mm. latis, 3.5-4 mm. crassis, basi rotundatis, apice cuspidatis, ventre complanatis levibus vel obscure sulcatis, dorso unicarinatis.

VITI LEVU: M b a : Hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu toward Lewa, alt. 750-850 m., Sept. 22, 1947, *Smith 6186* (A TYPE, US) (tree 5-10 m. high, in dense forest; fruit at length deep red).

Although the specimen cited above lacks flowers, it clearly represents a new species of the general alliance of *P. leptantha*, above described, from which it differs most obviously in its comparatively short calyx-limb. *Psychotria gracilior* further differs from *P. leptantha* in its completely glabrous habit, its comparatively narrow leaves, and its apparently smaller fruits, of which the pyrenes are differently proportioned. In spite of the general similarity of these two species in foliage, perhaps a closer alliance of *P. gracilior* is with *P. confertifolia* A. C. Sm., as indicated by the similarity in size of the calyx-limb. However, *P. confertifolia* is comparatively coarse in habit, with broader leaves generally obtuse at apex and with spreading secondaries, and with larger fruits.

DEPARTMENT OF BOTANY,
U. S. NATIONAL MUSEUM,
SMITHSONIAN INSTITUTION.

STUDIES IN THE THEACEAE, XXVII
MISCELLANEOUS NEW SPECIES IN THEACEAE

CLARENCE E. KOBUSKI

STUDY AND WORK on a single genus is never truly completed. The publication of such a work often incites an interest for even further study, as the author begins receiving unexpected material for identification — material which often changes his opinion of his own work supposedly completed. Such is the case in the genus *Adinandra*. Shortly after the publication of a review of the genus more than seven hundred additional specimens were received, mostly from Indonesia. These were sent primarily for my studies to be included in the *Flora Malesiana*. Several new species have been discovered among these specimens, and these are being included here, since considerable time will elapse before their descriptions will appear in the *Flora*. Also included are a few new entities in *Eurya* and *Freziera*. All are oriental except a single species of *Freziera* from Colombia.

***Adinandra anisobasis*, sp. nov.**

Arbor magna, 20–30 m. alta; trunco 30–60 cm. diametro; ramulis juvenilibus rubris, teretibus, adpresso-pubescentibus; ramulis maturis glabris, teretibus, brunneo-rubris; gemmis terminalibus conicis, dense aureo-adpresso-pubescentibus. Folia coriacea, late ovata vel elliptica, 8–14 cm. longa, 5–7 cm. lata, supra nitida, glabra, subtus pallidiora, pubescentia, punctata, apice obtusa, late acuminata vel rotundata, basi inaequalia, subrotundata, rare obtusa, margine integra, venis 10–12 paribus, undique elevatis, marginem intra anastomosantibus arcuantibusque, petiolis brevibus, ca. 2 mm. longis vel subsessilibus. Flores axillares, solitarii; pedicellis teretibus, ca. 1.5 cm. longis, brevi-adpresso-pubescentibus; bracteolis 2, persistentibus, oppositis vel suboppositis, late ovatis vel deltoideis, subaequalibus, ca. 2.5 cm. longis latisque, adpresso-pubescentibus; sepalis 5, imbricatis, late ovatis vel subrotundatis, duobus exterioribus ca. 5 mm. longis et 4 mm. latis, margine integris, dorso ad marginem dense adpresso-pubescentibus, tribus interioribus ca. 7 mm. longis et 5 mm. latis, margine scariosis, integris, dorso medio adpresso-pubescentibus; petalis 5, cremeo-albis basi connatis, obovatis, ca. 15 mm. longis, 5.5–7 mm. latis, integris, apice rotundatis, exteriore medio adpresso-pubescentibus; staminibus ca. 35, 3-vel 4-seriatis, filamentis ad basim corollae adnatis, 5–7 mm. longis, supra pubescentibus, ad basim glabris, antheris ca. 5 (–6) mm. longis, dense brunneo-pubescentibus; ovario globoso, glabro, ca. 4 mm. diametro, 5-loculari, mutiovulato, apice abrupte in stylum attenuato, stylo integro, glabro, ca. 10 mm. longo, stigmate punctiformi. Fructus maturus non visus.

BRITISH NORTH BORNEO: Mt. Kinabalu: Penataran river basin, Penataran river, in jungle near Lobang, alt. 3500 ft., *J. & M. S. Clemens 34154* (Bogor, TYPE; AA, fragment), July 25, 1933 (tree 70 ft.; diam. 1-2 ft.; flowers cream, the anthers brown). — Penataran river basin, Wusser River, alt. 3500 ft., *J. & M. S. Clemens 34035* (Bogor), July 22, 1933 (tree 80 ft. high., diam. 2 ft.; flowers cream-white, the anthers brown).

The outstanding characteristic of this species is the unequal base of the shining subsessile leaves. In this character it resembles *A. cordata*, also found on Mt. Kinabalu. However, the latter species can be separated by (1) the truly cordate leaf-base; (2) larger (20 × 10 mm.) glabrous corolla-lobes; and (3) larger calyx-lobes (12 × 18 mm.), broader than long.

Cited here may be a third specimen, unnumbered, collected by J. & M. S. Clemens at Penibukan, 4000 ft. altitude, on Mt. Kinabalu. This specimen is sterile but agrees with the species in foliage and branch characters.

***Adinandra endertii*, sp. nov.**

Arbor; ramis rubro-griseis, teretibus glabris (innovationibus leviter pubescentibus), gemmis terminalibus longo-conicis pubescentibus. Folia membranacea vel chartacea, elliptica, glabra, subtus punctata, 4-5 cm. longa, 1.3-1.7 (-2) cm. lata, apice acuta, basi cuneata decurrentiaque, margine integra vel subintegra, venis 7-9 paribus, petiolis circiter 3 mm. longis, subtus pubescentibus. Flores axillares, solitarii; pedicellis teretibus, tenuibus, circiter 2 cm. longis, glabris (basi saepe leviter adpresso-pubescentibus); bracteolis 2, oppositis, late ovatis vel subrotundatis, inaequalibus, 1.5-2.5 mm. longis, 2.5-3.5 mm. latis, persistentibus, in medio crassioribus, ut videtur glabris (sub magnificatione leviter adpresso-pubescentibus); sepalis 5, imbricatis, glabris (sub magnificatione leviter adpresso-pubescentibus), late ovatis, apice rotundatis, subaequalibus, ca. 7 mm. longis, 5-8 mm. latis; petalis 5, ovatis, ca. 6 mm. longis (in gemmis), dorso medio dense pubescentibus; staminibus numerosis, 3-seriatis?, filamentis glabris, ad basim corollae adnatis, antheris dense hirsutis; ovario subplano, glabro, 5-angulato, apice in stylum abrupte attenuato, 5-loculari, multiovulato. Fructus non visus.

EAST BORNEO: W. Koetai: near Kemoel, forest in very mountainous country, alt. 1600 m., *F. H. Endert 4135* (Arnold Arboretum, TYPE; Bogor, ISOTYPE), Oct. 14, 1925 (tree with greyish green buds).

In general characters this species resembles the Philippine species more closely than the Indonesian species. The smaller chartaceous elliptic leaves and the smaller, less robust flowers and floral parts remind one of *A. apoensis* Elmer of Mindanao. The Philippine species, however, can be separated by the coriaceous leaves, broadly rounded at the apex, with the margin serrate along the upper half. The filaments in *A. apoensis* are very hirsute — as hirsute as the anthers.

Adinandra laronensis, sp. nov.

Arbor ?; ramulis maturis teretibus, griseis, glabris; ramulis juvenilibus teretibus, rubris, adpresso-pubescentibus; gemmis terminalibus conicis, dense aureo-adpresso-pubescentibus. Folia coriacea, elliptica vel subelliptica, 7–13 cm. longa, 2.5–4 cm. lata, supra glabra, subtus glabrescentia, apice late acuta vel obtusa, basi cuneata, margine integra vel minute glanduloso-denticulata, venis ca. 12 paribus, marginem intra anastomosantibus arcuantibusque, petiolis brevibus, 2–3 mm. longis, glabris. Flores ignoti. Fructus immaturi axillares, solitarii; pedicellis teretibus, 1.5–2 cm. longis, glabris; bracteolis 2, oppositis, persistentibus, glabris, rotundatis vel subrotundatis, ca. 3 mm. longis latisque; sepalis 5, imbricatis, glabrescentibus (juvenilibus adpresso-pubescentibus), rotundatis, 5–7 mm. longis latisque; petalis non visis; fructibus immaturis globosis vel subglobosis, glabris, 5-locularibus, multiseminatis; seminibus nigris, nitidis, 2 mm. longis, reticulatis.

CELEBES: Gouvt. Celebes en Onderh.: Malili, near Larona, "*Mantri Boschwezen*" bb.2399 (Bogor, TYPE), Oct. 13, 1922. — Same locality, "*Mantri Boschwezen*" 1875 (Bogor).

This species owes its proposed status to its very distinct leaves. Ordinarily one would not suggest a new species on such sparse material, since only a single attached immature fruit is to be found. However, the rather thick coriaceous elliptic leaves make it stand out from the other species on the island. A third specimen (bb.3225) collected at the same locality and by the same collector, "*Mantri Boschwezen*," obviously an unknown assistant, might be cited here. The leaves in this third specimen are wider.

Adinandra loerzingiana, sp. nov.

Arbor 25 m. alta; ramis griseis, teretibus, glabris, cicatricibus magnis, ca. 4 × 3 mm., ramulis novellis rubris, leviter adpresso-pubescentibus; gemmis terminalibus longis, adpresso-fulvo-pubescentibus. Folia sessilia, crasso-coriacea, glabra, elliptica vel subelliptica, 10–15 cm. longa, 5–7 cm. lata, apice obtusa, subtiliter late acuminata, basi late cuneata, margine integra, venis prominentibus, primariis 20 (vel plus) paribus, marginem intra anastomosantibus, venis secundariis inter primarias frequentibus. Flores axillares, solitarii; pedicellis glabris, curvatis, teretibus, 2–2.5 cm. longis; bracteolis 2, suppositis, persistentibus, glabris, deltoideis, inaequalibus, ca. 2 mm. longis latisque; sepalis 5, imbricatis, glabris, subrotundatis, inaequalibus, exterioribus duobus minoribus, ca. 5 mm. longis et 7 mm. latis, interioribus tribus ca. 5 mm. longis et 12–13 mm. latis, margine late scariosis; petalis 5, basi connatis, glabris, cremeis, obovatis, inaequalibus, exterioribus ca. 15 mm. longis et 9 mm. latis, interioribus ca. 15 mm. longis et 12–13 mm. latis; staminibus ca. 40, ut videtur 4-seriatis, inaequalibus, 10, 11, 12 et 13 mm. longis, filamentis 4–5 mm. longis basi connatis, glabris vel apice leviter pubescentibus, antheris inaequalibus, 6, 7, 8, et 9 mm. longis, dense setiferis; ovario late conico, ca. 3 mm. longo,

5 mm. diam., ad apicem adpresso-pubescente, 2-loculari, pauci-ovulato, stylo glabro, integro, ca. 1.5 cm. longo. Fructus globosus vel subglobosus, glabrescens vel apice leviter adpresso-pubescent, 1.5–2 cm. diam., 2-locularis, pauci-seminatus, seminibus 2–10 (rare uno semine in quoque loculo), subplanis, hippocrepiformibus, 7–8 mm. longis, nitidis.

SUMATRA: Gouv't. Oostkust Sumatra: Afd. Sibolangit, near Bandar baroe, rare in primary forest, alt. 850 m., *J. A. Lörzing* 6862 (Bogor, TYPE), Sept. 7, 1919 (tree 15 m. with hard wood; flowers fragrant, cream-colored); same general locality, *J. A. Lörzing* 7040 (Bogor), Jan. 7, 1920 (tree 25 m. high).

This species is characterized by the sessile, thickly coriaceous, many-veined leaves, the persistent bracteoles, the two-celled ovary and fruit, and the few ovules and seeds. In some dissections a single seed was found in each locule of the fruit. The leaf-scars are unusually large, measuring as much as 5 mm. in diameter. This large scar is due to the unusually thickened base of the sessile leaves.

The only other two species known to have two-celled ovary and fruit are *A. nunkokensis* Kob. from Mt. Kinabalu, British North Borneo and *A. subsessilis* Airy-Shaw of Sarawak. In both *A. nunkokensis* and *A. subsessilis* the flowers are briefly pedicellate, longer (5 mm.) in the former species and subsessile in the latter. In both species the leaves are long-acuminate and the veins are fewer in number (6–8 pairs in *A. nunkokensis* and 12–14 pairs in *A. subsessilis*).

Adinandra kjellbergii, sp. nov.

Arbor (immatura) 6 m. alta; ramulis multis, teretibus, glabris, innovationibus leve adpresso-pubescentibus, gemmis terminalibus parvis, conicis, dense adpresso-pubescentibus. Folia coriacea, obovata, 5–9 cm. longa, 2–4 cm. lata, apice obtusa vel rotundata, late acuminata, basi cuneata, supra nitida glabra, subtus pallidiora, sparse adpresso-pubescentia, margine integra vel glanduloso-denticulata, venis undique obscuris, ca. 8 paribus, petiolis 7–10 mm. longis. Flores axillares, solitarii; pedicellis tenuibus, 1.5–2 cm. longis, sparse adpresso-pubescentibus vel glabrescentibus; bracteolis 2, oppositis, adpresso-pubescentibus, inaequalibus, una late rotundata, 2.5 mm. longa et 4 mm. lata et altera late ovata, 2.5 mm. longa et 3 mm. lata, apiculata; sepalis 5, imbricatis, rotundatis, 7–9 mm. longis, ca. 8 mm. latis, dense adpresso-pubescentibus; petalis 5, albis, basi connatis, obovatis, ca. 12 mm. longis, 6–8 mm. latis, exteriore medio aureo-adpresso-pubescentibus; staminibus ca. 40, bi-seriatis ut videtur, ca. 7 mm. longis, filamentis ad basim corollae adnatis, connatis, ca. 3 mm. longis, dense pubescentibus, antheris ca. 4 mm. longis, dense pubescentibus; ovario globoso, glabro, ca. 3 mm. diametro, apice subtruncato, 5-loculari, multiseminato. Fructus non visi.

CELEBES: Gouv't. Celebes en Onderh.: Makale, Rantepao, near Doa, alt. 1000 m., *J. van Zijl de Jong* 29/vz (Bogor bb.20268), Feb. 9, 1936 (young tree 6 m. high with white flowers). — Todjamboe, rare in rain forest, alt. 800 m.,

G. Kjellberg 2281 (Mus. Bot. Stockholm, TYPE; Bogor, ISOTYPE), Aug. 12, 1929 (tree ca. 15 m.).

In this species all the floral parts with the exception of the style and ovary are densely appressed-pubescent. In the stamens both the anthers and the filaments (except the portion touching the corolla) are densely pubescent. The ovary is unusual in that the apex is quite truncate rather than tapering, so that the style rises abruptly rather than gradually as is usually the case.

As the flowering material of the type was very sparse, only a single floral dissection was possible. However, the abundant pubescence on the floral parts is distinctive for any *Adinandra* in the region.

***Adinandra masambensis*, sp. nov.**

Arbor nondum adulta 25 m. alta; ramulis teretibus, robustis, rigidis, rubro-brunneis, partibus juvenilibus pubescentibus. Folia crasso-coriacea, elliptica vel ovato-elliptica, 7–12 cm. longa et 4–6.5 cm. lata, apice obtusa vel rotundata, submarginata, basi rotundata vel subcordata, supra glabra subtus juventute pubescentia, glabrescentia, costa supra canaliculata, subtus elevata, margine integra, venis undique obscuris, petiolis crassis, teretibus, ca. 5 mm. longis. Flores non visi. Fructus (juvenes) axillares, solitarii; pedicellis ca. 2.5 cm. longis, apice 3 mm. crassis; bracteolis 2, oppositis, persistentibus, adpresso-pubescentibus, latissimis, sublunatis, basi crassibus, inaequalibus, 5 mm. longis \times 9 mm. latis et 4 mm. longis \times 7 mm. latis, adpresso-pubescentibus, margine subciliatis; sepalis 5, imbricatis, crassis, subrotundatis, adpresso-pubescentibus subaequalibus, 9–10 mm. longis et 11–12 mm. latis; ovario globoso, ca. 5 mm. diametro, glabro, 5-loculari, multiovulato; stylo fracto.

CELEBES: Gouv't. Celebes en Onderh.: Masamba, near Rato, rare, alt. ca. 1000 m., *F. Grot 6* (Bogor, *bb.* 26298, TYPE), Sept. 11, 1938 (young tree 25 m., diameter 30 cm.; flowers white).

Outstanding characteristics of this new species are (1) the thick coriaceous pubescent leaves, almost elliptic in shape, subretuse at the apex, rounded or subcordate at the base, *not* decurrent into the petiole, with obscure veining; (2) the persistent bracteoles, much broader (9 mm.) than long (5 mm.).

Its closest relative appears to be *A. cordata* from British North Borneo. This latter species can be separated by its glabrous leaves, sharply oblique-cordate at the base, obtusely acuminate at the apex, with ten to twelve conspicuous pairs of veins, and its sericeous ovary.

Neither flowers nor mature fruit were available for this study. However, the glabrous, five-celled fruit, although immature, and the unusual leaves show the species to be distinct from its nearest relatives and so worthy of description.

Adinandra rantepaoensis, sp. nov.

Arbor ca. 15 m. alta; ramulis paucis, teretibus, glabris; gemmis terminalibus glabris. Folia crasso-coriacea, elliptica vel ovato-elliptica, 13–19 cm. longa, 5.5–8 cm. lata, apice late ovata vel obtusa, subacuminata, basi cuneata in petiolum decurrentia, margine integra, venis 8–10 paribus, undique conspicuis, adscendentibus, ad marginem anastomosantibus, petiolis ca. 1.5 cm. longis, glabris. Flores solitarii, axillares; pedicellis glabris, teretibus, 2.5–3.5 cm. longis, 2.5–3 mm. crassis, apice curvatis; bracteolis 2, oppositis, crassis, glabris, subaequalibus, latioribus quam longis, semi-rotundatis, 4–5 mm. longis, 7–9 mm. latis, integris; sepalis 5, imbricatis, glabris, crassis, subrotundatis, exterioribus duobus 12 mm. longis et 14 mm. latis, interioribus tribus 9 mm. longis et 11 mm. latis; petalis (immaturis) 5, obovatis, ca. 15 mm. longis et 12 mm. latis, apice subacutis, dorso dense pubescentibus (margine excepto); staminibus ca. 60, ut videtur 3-seriatis, ca. 10 mm. longis, dense pubescentibus, filamentis connatis, ca. 7 mm. longis, basi ad corollam adnatis, antheris ca. 3 mm. longis; ovario globoso vel subgloboso, 6–7 mm. diametro, dense luteo-pubescente, 5-loculari, multiovulato, pericarpio crasso; stylo 7 mm. longo, glabris basi excepto; stigmatibus punctato. Fructus non visi.

CELEBES: Gouv't. Celebes en Onderh.: Rantepao, Bala, Balambang, alt. 1600 m., *J. K. Thenu* 19 (bb. 11857) (TYPE, Bogor), Sept. 6, 1927 (tree ca. 15 m.). — Same locality, *J. K. Thenu* 8 (bb. 11846) (Bogor).

This distinctive species is characterized by large heavy-coriaceous glabrous leaves with eight to ten widely spaced primary veins. The leaf-base is cuneate and decurs into the petiole, nearly to its base. The floral parts are all large. A single stamen adhering to the lobe of the calyx shows that at maturity the longer stamens may measure up to ten mm. The corolla, which was described above from a bud, may be considerably extended at anthesis. The cell cavity of the ovary is rather small and appears to be confined to a small area near the base of the ovary. It measures only ca. 2 mm. in diameter. The pericarp is very thick, measuring about 2 mm. thick at the base. The upper two thirds of the ovary is dense and of the same texture as the pericarp, with no cell structure obvious.

Adinandra rubiginosa, sp. nov.

Arbor 25 m. alta, trunco angulatissimo, 40 cm. diametro; ramulis teretibus, rubro-brunneis, pubescentibus; gemmis terminalibus dense hirsutis. Folia coriacea, oblongo-ovata, 10–15 cm. longa, 3.5–4 cm. lata, supra glabra, rubiginosa, subtus dense rubro-brunnea hirsuta, apice acuta, basi cuneata, margine integra, venis obscuris, petiolis crassis, ca. 5 mm. longis et ca. 3 mm. diametro. Flores axillares, solitarii; pedicellis crassis, recurvatis, teretibus, 5 mm. longis, 3 mm. diametro; bracteolis 2, oppositis, persistentibus, crassis, semi-rotundatis, inaequalibus ca. 3 mm. longis \times 4 mm. latis et 2 mm. longis \times 4 mm. latis, dorso pubescentibus, margine ciliatis; sepalis 5, imbricatis, inaequalibus, duobus exterioribus rotundato-

ovatis, 5 mm. longis, basi 5 mm. latis, pubescentibus, tribus interioribus subrotundatis, glabris, ca. 7 mm. longis, 5 mm. latis, margine scariosis; petalis (immaturis) 5, dorso glabro; staminibus (immaturis) ca 30, 3-seriatis ?, filamentis basi connatis, ad basim corollae adnatis, subtus, glabris, super hirsutis, antheris elongatis, ca. 3 mm. longis, dense hirsutis, apice apiculatis; ovario semi-globoso, 5-loculari, multiovulato, apice abrupte in stylum attenuato, stylo glabro, integro, stigmate punctiformi. Fructus (immaturus) globosus, glaber, 5-locularis, multiseminatus, stylo 13 mm. longo.

BORNEO: Subdiv. W. Koetai: near Kemoel, in forest on steep ravine wall, alt. 1100 m., *F. H. Endert 3869* (AA, TYPE; Bogor, ISOTYPE), Oct. 10, 1925 (tree 25 m. high, 25 cm. diam.; trunk very angular; flowers white).

This species is characterized by dark red, coriaceous, oblong-ovate leaves glabrous on the upper surface (even in the terminal bud) and densely hirsute on the lower surface, becoming glabrescent. The pubescence on the younger leaves is striking in that it appears to be densely distributed in distinct longitudinal striae. Although not an unusual occurrence in other pubescent species of the family, this character is unusual in *Adinandra*. Also characteristic is the short thick pedicel.

Although both flowers and fruit were available for this study, it is unfortunate that neither was mature. The petals and stamens were described from a bud, making accurate measurements quite impossible. However, the diagnostic characters were discernible, showing this species to be distinct.

***Adinandra steenisii*, sp. nov.**

Arbor parva, ad 5 m. alta; ramulis multis, congestis, glabris, juventute adpresso-pubescentibus; gemmis terminalibus luteo-adpresso-pubescentibus. Folia coriacea, rotundata, parva, 1–2 cm. longa, 0.8–1.5 cm. lata, apice rotundata, subretusa, basi cuneata, supra glabra, subtus cito glabrescentia, margine integra vel rare crenulata, venis 5–7 paribus, supra obscuris, subtus conspicuis, adscendentibus ad marginem anastomosantibus, petiolis teretibus, glabris, 1–1.5 mm. longis. Flores non visi. Fructus axillares, solitarii; pedunculis teretibus, ca. 1 cm. longis, glabris; bracteolis 2, oppositis, subaequalibus, latoribus quam longis, semi-rotundatis, 1.7–1.8 mm. longis, ca. 3 mm. latis, glabris; sepalis 5, imbricatis, glabris, subaequalibus, rotundatis, 6–8 mm. longis, ca. 8 mm. latis. Fructus globosus, glaber, 8–10 mm. diametro, 5-locularis, multiseminatus, stylo glabro, ca. 10 mm. longo, stigmate punctato.

CELEBES: Gouvt. Celebes en Onderh: Route Rante Lemo-Angin Angin via Poka Pindjang, alt. 2500 m., *C. G. G. J. van Steenis 10303* (TYPE, Bogor), June 19, 1937 (small tree \pm 5 m. high).

This species is very distinctive and can be easily recognized by its small habit (tree to 5 m. high), the very small rotund leaves (1–2 cm.

long), with the petiole measuring only 1–2 mm., and the small fruit. In general, all the parts seem to be in miniature.

The flowers were not seen, and the fruit as described above probably was immature. However, the species should be easily recognized in the future.

This species is named after C. G. G. J. van Steenis, the collector.

***Adinandra subauriculata*, sp. nov.**

Arbor ad 22 m.; ramis griseis, teretibus, crassis, glabris; gemmis terminalibus ignotis. Folia crasso-coriacea, ovata, glabra, 10–17 cm. longa, 5–6 cm. lata, apice obtusa, basi rotundata, subauriculata, margine minute glanduloso-denticulata, costa subtus conspicua, venis lateralibus ca. 20 primariis paribus, gracilibus ad marginem anastomosantibus, venis secundariis inter primarias frequentibus, petiolo brevi, crasso, ca. 5 mm. longo. Flores non visi. Fructus axillares, ut videtur solitarii; pedicellis glabris, teretibus, brevibus, 0.5–1.5 cm. longis, crassis, ca. 2–3 mm. diam.; bracteolis caducis; sepalis 5, imbricatis, persistentibus, ovatis vel late ovatis, ca. 1 cm. longis et 7 mm. latis, leviter adpresso-pubescentibus. Fructus globosi vel subglobosi, leve pubescentes vel glabrescentes, ca. 2 cm. diam., 3-loculares, multiseminati, seminibus subplanis hippocrepiformibus, nigris, nitidis, ca. 5 mm. longis, 3–4 mm. latis.

SUMATRA: Res. Sumatra's Westkust: Soeliki, in old forest, alt. 1300 m., *Neth. Ind. For. Serv. bb. 6538* (TYPE, Bogor; ISOTYPE, Arnold Arboretum), Feb. 16, 1924 (tree 22 m. high, 8 m. to first branch, 40 cm. diam. breast high; fruit green, malodorous, bitter).

The outstanding characters of this species are (1) the thick-coriaceous leaf with a rounded subauriculate base and a short thick petiole; (2) a pubescent three-celled fruit with many (up to eighty) flattened hippocrepiform shiny seeds. The latter character is unusual in the genus in that most species with three-celled fruits are known to possess very few (not more than twenty) large seeds, usually thicker than those found in this species. Several fruits were carefully dissected and all showed at least sixty well-developed seeds.

The closest relative appears to be *A. cordifolia* Ridley, found in Sarawak and British North Borneo. In this species the fruit is five-celled, the leaves are distinctly cordate (unequally so) at the base, subsessile or with a very brief petiole.

***Adinandra subunguiculata*, sp. nov.**

Arbor ad 15 m. alta; ramulis maturis innovationibusque glabris, teretibus; gemmis terminalibus conicis, aureo-adpresso-pubescentibus. Folia coriacea, glabra, obovata vel subelliptica, 9–12 cm. longa, 4–6 cm. lata, apice late acuminata vel obtusa, basi cuneata, margine integra vel minute denticulata, venis 12 paribus vel plus, obscuris, petiolis 4–5 mm. longis. Flores axillares, solitarii; pedicellis glabris, 3.5–4.5 cm. longis, ad apicem

accrescentibus; bracteolis 2, alternatis vel suboppositis, inaequalibus, bracteola superiore rotundata, ca. 2 mm. longa et 3 mm. lata, glabra, bracteola inferiore deltoidea, ca. 1.5 mm. longa et basi 1.5 mm. lata, glabra; sepalis 5, imbricatis, subrotundatis, subaequalibus, 5–6 mm. longis, 6–8 mm. latis, glabris, interioribus rare exceptis, dorso medio minutissime adpresso-puberulentis, cito glabrescentibus; petalis 5, glabris, inaequalibus, exterioribus obovatis, 14 mm. longis, 11 mm. latis, interioribus subunguiculatis, 11 mm. longis, 8 mm. latis; staminibus 40–45, 4-seriatis ut videtur, 4–7 mm. longis, filamentis connatis, glabris, ad basim corollae adnatis, 2–3.5 mm. longis, antheris setosis, 2–3.5 mm. longis; ovario conico vel subgloboso, glabro, 5-loculari, multiovulato, stylo glabro, ca. 1 cm. longo. Fructus globosus, glaber, ca. 1 cm. diametro, 5-locularis, multi-seminatus; seminibus nigris, nitidis, reticulatis.

CELEBES: Gouv't. Celebes en Onderh.: MALILI: near Tabaramo, alt. 600 m., *A. Hoornstra* 32 (Bogor *bb.9710*), Apr. 9, 1926 (tree 17 m., with white flowers). KENDARI: N. Kendari, rain-forest, alt. 150–300 m., *G. K. Kjellberg* 641 (Bogor, TYPE), March 3, 1929. — Poehara, rain-forest, alt. 100 m., *G. K. Kjellberg* 698 (Bogor), March 6, 1929. — Peninsula, southeast of Lepo-Lepo, *O. Beccari* 1190, 1190A, 1190B (Firenze), July 1874. — "BOETON EIL MOENA": Laboenti, alt. 15m., *C. P. Burghaut* 85 (Bogor *bb.5860*), July 28, 1923 (tree 14 m. with white flowers). MOENA: Labouti, *A. G. Waturandang* 250 (Bogor, *bb.21788*), January 22, 1937 (tree 15 m. with white flowers).

This species is one which cannot be placed in close association with any other species of the genus, yet has no truly outstanding characteristics of its own to separate it from all others! The bracteoles are usually sub-alternate. All the floral parts except the setose anthers are glabrous, the terminal bud is tawny appressed-pubescent, yet the early leaves and the young branchlets are glabrous or quickly become so. The ovary is five-celled with very many characteristic small ovules.

From the label of Bogor 5860 I cannot be certain of the place of collection — whether from Moena or the near-by island of Boeton. However, I am inclined to feel that it was collected on Moena, considering the almost duplicate label of *Bogor 21788*.

Adinandra dubia, sp. nov.

Frutex; ramulis juvenilibus teretibus, sericeis; ramulis maturis glabris vel glabrescentibus, griseis, teretibus; gemmis terminalibus conicis, dense aureo-sericeis. Folia coriacea, ovata vel elliptico-ovata, 6–11 cm. longa, 2–3.5 cm. lata, supra nitida, glabra, subtus pallidiora, pubescentia, apice acuminata, basi cuneata, margine denticulata (juventute glanduloso-denticulata), venis ca. 10 paribus, undique leve elevatis, marginem intra anastomosantibus arcuantibusque, petiolis 7–10 mm. longis, subtus pubescentibus. Flores axillares, solitarii; pedicellis teretibus, 5–8 mm. longis, recurvatis, sericeis; bracteolis 2, suboppositis, longo-triangularibus, 6–6.5 mm. longis, basi 3–4 mm. latis, adpresso-sericeis, margine glanduloso-denticulatis, cito caducis; sepalis 5, imbricatis, inaequalibus, dense sericeis, late ovatis, ex-

terioribus 6–7 mm. longis, 5–6 mm. latis, interioribus 4–5 mm. longis, 2.5–4 mm. latis; petalis 5, dorso medio adpresso-sericeis, oblongo-ovatis, 3–5 mm. longis, ca. 2 mm. latis; staminibus ut videtur 1-seriatis, paucis (ca. 20) ad 2.25 mm. longis, filamentis 0.5 mm. longis, connatis, ad basim corollae adnatis, glabris, antheris 0.5–1.5 mm. longis, apice retusis, interiore dense hirsutis; ovario minuto, 1.5 mm. diametro, 5-loculato, multiovulato, glabro vel minute pubescente, stylo ca. 2.5–3 mm. longo, glabro vel minute adpresso-pubescente. Fructus ignotus.

SUMATRA: Res. Sumatra's Westkust: Ophir District, northwest slope of Talamau, alt. 2100 m., *H. A. B. Bunnemeijer 910* (Bogor, TYPE), May 28, 1917 (shrub).

Adinandra dubia, as the specific name intimates, is a provocative species. Every so often a worker is confronted with a specimen which seems to conform to a certain genus in all respects, yet instinctively a doubt persists as to its real position. Such is the case with *A. dubia*. The flowers are very small, with the corolla measuring only three to five millimeters long and two millimeters wide. The bracteoles are nearly petaloid and are actually larger (ca. 6 mm. long) than the petals, a most unusual feature in this genus. Minute are the stamens, the longest ones measuring only 2.5 mm. in length. They are also very few in number yet so closely joined together in the specimens dissected that an accurate count could not be obtained. The copious pubescence usually found on the anthers in most species of the genus is sometimes so sparse and scattered in *A. dubia* as to be almost negligible.

Closely allied and perhaps belonging here is a specimen collected by *Mareman* [Forest Res. Inst. 6216] at the Hoogvlakte area near Lake Toba in the Tapanoei Res. Collected at a lower altitude [900 m.], the habit is that of a tree 21 meters high, which in itself is not unusual. However, the immature fruit is quite conical in shape and densely sericeous. So also is the style. This very noticeable difference in pubescence, especially since the Mareman specimen was collected in fruit, cannot be overlooked. A reversed situation would be quite understandable.

***Eurya perserrata*, sp. nov.**

Frutex 3 m. (fide collector) altus, ramulis teretibus, innovationibus rufo-pilosis. Folia subcoriacea, oblongo-elliptica vel oblongo-ovata, 14–18 cm. longa et 4.0–6.5 cm. lata, apice acuminata, basi late cuneata, subtus pilosa, venis utrinque conspicuis, margine acre glanduloso-serrata, serrationibus inaequalibus ad 2 mm. longis, sessilia vel subsessilia. Flores ♂ 2–3 in axillis foliorum, albi; pedicellis 1.5–2 mm. longis; bracteolis minutis, sepaloideis, ca. 1 mm. longis; sepala 5, imbricata, inaequalia, subrotundata, concava, 3–3.5 mm. longa et 2–2.5 mm. lata, extus intusque strigosa, margine scariosa, ciliata; petala 5, imbricata, inaequalia, oblongo-obovata, 5–6 mm. longa et 2.5–3 mm. lata, obtusa; stamina ca. 15, filamentis ca. 2.5 mm. longis, antheris ca. 1 mm. longis. Flores ♀ et fructus ignoti.

CHINA: Yunnan: Muchielung, Salwin-Kiukiang Divide, in dense mixed forest, alt. 2500 m., *T. T. Yü 21035* (Arnold Arboretum, TYPE), Nov. 21, 1938, shrub 3 m. with white flowers.

Unfortunately, neither pistillate flowers nor fruit are available for study in this species. However, the serration on the leaves in the staminate plants is so outstanding that when the pistillate specimens are found they will be easily recognized. The serrations are approximately 2 mm. long (or more), surely the most conspicuous feature on the specimen. No other species in the genus approaches *E. perserrata* in this character. The rufous pilose terminal buds, the sessile or near-sessile leaves, and the large flowers are other outstanding characters.

***Eurya pseudocerasifera*, sp. nov.**

Arbor magna (30 m., fide Tsai), ramulis teretibus, innovationibus pubescentibus. Folia oblongo-elliptica, coriacea, decurrentia, 9–13 cm. longa et 3–5 cm. lata, apice acuminata, basi cuneata, supra nitida, subtus opaca, margine integerrima, glabra, basi costae excepta, venis elevatis subtus conspicuis, petiolis ca. 5 mm. longis, pubescentibus. Flores ♀ axillares, 3-fasciculati, albi; pedicellis ca. 3 mm. longis, pubescentibus; bracteolis minutis, sepaloideis, pubescentibus; sepalis 5, imbricatis, inaequalibus, concavis, subrotundatis, ca. 2 mm. longis et 2 mm. latis, pubescentibus, marginibus scariosis ciliatisque; petalis 5, imbricatis, inaequalibus, ca. 3 mm. longis et 2 mm. latis, obtusis, apice rotundatis vel subemarginatis; ovario globoso, piloso, ca. 2 mm. diametro, 3-loculari, multiovulato, stylo 3- vel 4-partito, ca. 5 mm. longo, glabro, 1/2 libero; flores ♂ ignoti. Fructus (*T. T. Yü 17251*) baccatus, globosus, 4–5 mm. diametro, glabrescens, multiseminatus; semina minuta, nigro-nitida, reticulata, ca. 1 mm. diametro.

CHINA: Yunnan: Lung-ling Hsien, in woods, alt. 2300 m., *H. T. Tsai 55002* (Arnold Arboretum), Jan. 7, 1934 (tree 20 ft. high with white flowers). — Mong-ka, in forest, alt. 1750 m., *H. T. Tsai 56882* (Arnold Arboretum, TYPE), Feb. 9, 1934 (large tree 100 ft. high with yellow fruit). — Chenkang, Snow Range, Tapingchang, common in ravine among forest trees, alt. 2350 m., *T. T. Yü 17251* (Arnold Arboretum), Aug. 6, 1938 (tree 20–25 ft. high). — Taron-Taru Divide, Tangtehwan, in mixed forest, alt. 1800 m., *T. T. Yü 19974* (Arnold Arboretum), Aug. 27, 1938 (tree 30 ft. high).

This species is characterized by the entire leaves, the pubescent ovary, and the long style (five millimeters), three- or four-parted, the branches free for one half the length. Also most unusual is the size, recorded by Tsai (56882) as a big tree attaining a height of a hundred feet. None of the three other specimens examined and cited above is recorded as taller than thirty feet.

This species resembles *E. cerasifolia* (D. Don) Kob. superficially in the entire shining leaves and the conspicuous veining. However, in *E. cerasifolia* the leaves are not truly entire. Serration may be found on the upper half of the leaf, and then often confined to a single side. Also in *E. cerasi-*

folia, the ovary is glabrous, the style is shorter (two millimeters) and joined nearly its whole length.

Another species in close relationship is *E. pittosporifolia* Hu. The original author recorded this species as a tree six meters high with glabrous branchlets, oblanceolate leaves, long-acuminate at the apex and narrow-cuneate at the base, entire or crenulate on the upper two thirds. The sepals were reported as glabrous and the fruit densely ferrugineous-sericeous. The styles were listed as five and distinct. In examining the isotype of *E. pittosporifolia* (C. W. Wang 78362), one finds also that the terminal buds are distinctly pilose and the sepals strigose.

***Freziera cuatrecasasii*, sp. nov.**

Arbor magna, ramis teretibus, undulatis, crassis, pubescentibus, lenticellatis, lenticellis numerosis, prominentibus, elevatis, subsuberosis, ramulis hornotinis dense fulvo-pilosulis. Folia coriacea, ovata, 18–23 (–33) cm. longa, 7–10 (–14.5) cm. lata, apice abrupte acuminata, basi subrotundata, conspicue inaequalia, margine integra, costa supra canaliculata, subtus basi ad 5 mm. elevata, supra glabra (juventate fulvo-pubescentis, cito glabrescentis), subtus pubescens, venis lateralibus 30–37 paribus undique prominentibus, reticulatis, petiolis ca. 1 cm. longis, pubescentibus, alatis. Flores axillares et cauliflori in axillis defoliatis pedicellati in fasciculum pedunculatum aggregati; pedicellis 3 mm. longis vel minus, curvatis, crassis, pubescentibus; bracteolis 2, oppositis, subrotundatis, ca. 3 mm. longis latisque, dense fulvo-pubescentibus; sepalis 5, imbricatis, adpresso-pubescentibus, rotundatis, ca. 4 mm. longis et 5 mm. latis, margine anguste scariosis, integris; petalis 5, albis, inaequalibus, 6–7 mm. longis, ca. 4.5 mm. latis, exterioribus duobus ovatis, non apiculatis, interioribus tribus apice acutis; staminibus (♀ fl.) ca. 15, uniseriatis, ca. 3 mm. longis, filamentis ca. 1 mm. longis, paucis claviformibus, antheris ca. 2 mm. longis; ovario glabro, conico, ca. 2 mm. diametro basi, apice attenuatis per stylum ca. 3 mm. in stigmatem, 5-loculari, multiovulato. Fructus ca. 7 mm. diametro, glaber, 5-locularis, multiseeminatus.

COLOMBIA: Dept. del Valle, Cordillera Occidental, Hoya del río Digua, Río San Juan, 1300–1500 m. alt., abajo de Queremal a la derecha del río entre km. 52–53, *J. Cuatrecasas* 23985 (Arnold Arboretum, TYPE; Chicago Nat. Hist. Mus., ISOTYPE), Mar. 27, 1947 (gran árbol; hoja coriácea rígida, verde oscura brillante haz, verde pálida envés; sépalos verdes; pétalos blancos).

This species is most closely allied to *F. guatemalensis* in its pedunculate, fasciculate flowers, and to *F. Smithiana* in its large multiveined leaves and dense fulvous pubescence. It may be separated from the latter species by the pedunculate flowers, the shorter pedicels and petioles, the entire margin of the leaves, the presence in quantity of the conspicuous lenticels, and the somewhat undulate branches.

The outstanding features for this species are the huge coriaceous leaves measuring as much as 33 cm. long and 14.5 cm. wide, conspicuously veined, the pedunculate flowers (with the scales of former flowers below) both in

the axils of the leaves and on the stem in the defoliated axils. The large leaf-scars, along with the so-called cauline flowers, give to the older branches a somewhat undulate appearance which is missing in the younger branches and branchlets.

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ILEX IN TAIWAN AND THE LIUKIU ISLANDS

SHIU-YING HU

INTRODUCTION

IN PREPARING A FLORA OF OKINAWA, Dr. E. H. Walker, Associate Curator, Department of Botany, Smithsonian Institution, asked me to comment on the portion of his manuscript devoted to *Ilex*. Although in my studies of the Chinese species of that genus I included some Taiwan forms, chiefly those occurring on both the island and the mainland of China, my study of the insular material was not exhaustive. As I possessed even less knowledge of the Liukiu Islands species I scarcely felt competent to accept his invitation. Yet my knowledge of the Chinese species of *Ilex* enabled me to assure him that the two Chinese species included in his manuscript do not occur in the Liukiu Islands. As to the other species I was uncertain and requested him to send me as much Okinawan material as possible. In the identification of these specimens I was naturally forced to consider all the known species of Taiwan and the Liukiu Islands. The results of this study are included in this paper.

This paper is supplementary in nature to my publications on THE GENUS *ILEX* IN CHINA.¹ Descriptions, synonyms, and the citations of literature and specimens relating to the species treated therein are not repeated here; however, references to that former work have been included. The specimens marked US are deposited in the United States National Herbarium, and those marked G are in the Gray Herbarium. All other cited specimens, whether designated by A or not, are in the Herbarium of the Arnold Arboretum.

Through Professor E. D. Merrill I have been able to obtain photographs and fragments of types from Dr. Siro Kitamura, Director of the Botanical Institute, Kyoto University, Kyoto, Japan, and Dr. H. Hara of the Botanical Institute, Tokyo University, Tokyo, Japan. To both of these men and to the Curators of the above-mentioned institutions I should like to express my deep appreciation for their help in clarifying certain nomenclatural problems in my study of the *Ilex* of Taiwan and the Liukiu Islands.

PHYTOGEOGRAPHICAL SIGNIFICANCES

The geographic distribution of the Taiwan and Liukiu Islands species of *Ilex* reflects the floristic relationships of the areas covered, and to a certain extent it also illustrates the affinity of the floras of these islands to those of the Chinese mainland and Japan, as well as that of the Philippine Islands.

¹ Journal of the Arnold Arboretum 30: 233-344, 348-387, 1949; 31: 39-80, 214-240, and 241-263, 1950.

In Taiwan twenty-two valid species occur. Twelve of these occur also on the Chinese mainland. Six of the twelve are confined to China and Taiwan, while four, *I. goshiensis* Hayata, *I. micrococca* Maxim., *I. pedunculosa* Miq., and *I. rotunda* Thunb., are widely spread in China, occurring also in Japan and, in some cases, in Korea or Indo-China. Two other species, *I. asprella* (Hook. & Arn.) Champ. and *I. formosana* Maxim., occur also in the Philippines. Among the species confined to Taiwan and China (and closely adjacent regions), two, *I. bioritsensis* Hayata and *I. yunnanensis* Franch., are restricted to the higher altitudes of western China and central Taiwan, and the others, *I. cochinchinensis* Lour., *I. ficoidea* Hemsl., *I. pubescens* Hook & Arn., and *I. triflora* Blume var. *kanehirai* (Yamamoto) S. Y. Hu, are subtropical species which occur in the coastal provinces on the mainland and in the southern part of Taiwan. Some of these also occur in Hainan and in northern Indo-China. It is worthy of note that, although there are four widely spread species that Taiwan shares with Japan and China, there is only a single taxon, *Ilex sugeroki* Maxim. var. *brevipedunculata* (Maxim.) S. Y. Hu, that is confined to Taiwan and Japan. There is no species that is confined to Taiwan and the Philippines. It is also interesting to note that six species, *I. buergeri* Miq., *I. chinensis* Sims, *I. crenata* Thunb., *I. latifolia* Thunb., *I. macropoda* Miq., and *I. serrata* Thunb., which are common in Japan and eastern China, have not been found in either Taiwan or the Liukiu Islands.

Thus for the *Ilex* species of Taiwan, approximately 54% are Chinese elements, 23% are endemic, 18% are shared with the flora of the Liukius, and a very minor percentage are Japanese elements. The genus is strongly marked and easily recognizable and comprises an extraordinary number of distinct species, both deciduous and evergreen. They are in general very specific in their association with different types of vegetation. For example, *I. bioritsensis* Hayata is associated with plants constituting the broad-leaved forests of the secondary order, while *I. yunnanensis* Franch. var. *parvifolia* (Hayata) S. Y. Hu is found only along the edge of the coniferous forests. Due to this fact certain species can be used to a considerable extent as indicators of the type of vegetation in their native habitats. Therefore it may perhaps be a legitimate assumption that the proportion of Chinese, Japanese, and endemic elements existing in the *Ilex* flora of Taiwan is likely to prevail in other genera. As illustrated by the species of *Ilex*, the Taiwan flora is strongly affiliated with that of the China mainland, while the affinity between the flora of Taiwan and that of Japan is weak. The chief Philippine Islands elements are not found in Taiwan proper at all, but are limited to Botel Tobago.

There are twelve valid species of *Ilex* in the Liukiu Islands, four of which are endemic. Four species are limited to Taiwan and the southern Liukiu Islands, and one occurs only in Japan and the northern Liukiu Islands. *Ilex goshiensis* Hayata has a range extending from the Liukius and Taiwan north to Japan and south to Hainan Island. There is also in the Liukiu group one widely spread Chinese subtropical element, *I. ficoidea* Hemsl., and another widely spread Sino-Japanese species, *I. rotunda* Thunb.

If the genus *Ilex* may be taken as a criterion, the flora of the Liukiu Islands is characterized by a rather high degree of endemism.

Binomials like *Ilex mertensii* Maxim. and *Ilex matanoana* Makino, which are species endemic to the Bonin Islands, appear repeatedly in literature concerning the floras of Taiwan and the Liukiu Islands. As a matter of fact, however, the Bonin Islands species are morphologically very different, and their affinities with the plants of the group of small islands extending southward toward the Micronesias and the Caroline Islands seem to be closer than with the plants of Taiwan and the Liukiu Islands. At least it appears to me that none of the Taiwan and Liukiu material should carry the names applied to the species of the Bonin Islands.

KEY TO SUBGENERA, SECTIONS, AND SPECIES

- A. Leaves deciduous, branchlets with abbreviated shoots, each bearing a fascicle of leaves and flowers; lenticels conspicuous on the current year's growth. Subgen. PRINOS.
- B. Inflorescence a trichotomously branched cyme bearing 15 or more flowers; fruit small, with smooth pyrenes, each longitudinally canaliculate on the back. Sect. **Micrococca**.
 - 1. *I. micrococca*.
- BB. Inflorescence a solitary flower or a simple 3-flowered cyme, often fasciculated with the leaves at the end of an abbreviated shoot; fruit medium-sized, with striate and sulcate pyrenes; endocarp woody or stony. Sect. **Prinoides**.
- C. Leaves ovate, entirely glabrous, obtuse or shortly and broadly acuminate at the apex; ovary with no evident style; pyrenes woody, striate. 2. *I. kusanoi*.
- CC. Leaves ovate-elliptic, hirsute on the nerves above, acuminate, the acumen up to 12 mm. long; style evident; pyrenes stony, striate and deeply sulcate. 3. *I. asprella*.
- AA. Leaves evergreen; branchlets without abbreviated leafy shoots; lenticels usually absent on the current year's growth. Subgen. EUILEX.
- B. Pistillate and staminate inflorescences both solitary in the axils of leaves on the current year's growth; pyrenes smooth, with coriaceous or sublignescant endocarps, slightly concave, unicanalicate or 3-striate and 2-sulcate on the back. Sect. **Lioprinus**.
- C. Inflorescence cymose; pyrenes concave or unicanalicate at the back.
 - D. Fruit ovoid-globose, 5-7 mm. in diameter; pyrenes 4-5 mm. long, dorsally concave; pedicels slender; leaves pubescent on both surfaces (except var. *hakkuensis*). . . . 4. *I. lonicerifolia*.
- DD. Fruit ellipsoid, 8-10 mm. in diameter; pyrenes 8 mm. long, deeply unicanalicate on the back; pedicels stout; leaves glabrous. 5. *I. matudai*.
- CC. Inflorescence umbelliform; pyrenes 3-striate and 2-sulcate at the back; leaves entire. 6. *I. rotunda*.
- CCC. Inflorescence subcapitate; the pyrenes smooth, slightly concave on the back; the fruit ellipsoid-globose, 5-7 mm. in diameter. 7. *I. tugitakayamensis*.

- BB. Pistillate flowers solitary, axillary in the scales or leaves on the current year's growth, very rarely fasciculate; staminate flowers fasciculate on the second year's growth, rarely solitary and axillary in the scales or leaves at the base of current year's growth; pyrenes smooth or slightly roughened; the endocarp coriaceous. Sect. **Paltoria**.
- C. Leaves not punctate beneath.
- D. Petioles 8–17 mm. long, up to one third the length of the lamina; leaves usually entire, rarely serrate, the midribs plane or slightly impressed above. 8. *I. pedunculosa*.
- DD. Petioles 2–7 mm. long, up to one seventh the length of the lamina; leaves usually serrate, the midrib elevated and pubescent above.
- E. Pyrenes 4; branchlets thickly ferruginous-pubescent; leaves aristately serrate, extending almost to the base. 9. *I. yunnanensis* var. *parvifolia*.
- EE. Pyrenes 4, 5, or 6; branchlets puberulous; leaves serrate or crenate only near the apex, the basal half entire. 10. *I. sugeroki* var. *brevipedunculata*.
- CC. Leaves punctate beneath.
- D. Pistillate flowers and fruit solitary; leaves elliptic or oblanceolate, apex acute or shortly acuminate.
- E. Leaves elliptic, the apex acute; petioles 7–10 mm. long; ca. one third the length of the lamina. 11. *I. maximowicziana*.
- EE. Leaves oblanceolate; broadly acuminate; petioles 3–6 mm. long, ca. one eighth the length of the lamina. 12. *I. mutchagara*.
- DD. Pistillate flowers and fruit fasciculate; leaves obovate or oblong, the apex rounded. 13. *Ilex triflora* var. *kanehirai*.
- BBB. Pistillate and staminate inflorescences both fasciculate, axillary on the second year's growth; pyrenes rugose, pitted or striate with elevated striae; endocarp woody or stony.
- C. Pyrenes 4 or 2; endocarp woody or stony; individual branches of the inflorescence uniflorous. Sect. **Aquifolium**.
- D. Leaves entire or spiny margined.
- E. Fruit large, 9–12 mm. in diameter; pyrenes stony, irregularly wrinkled and pitted; leaves entire, acuminate, (4–) 6–7 (–8) cm. long.
- F. Fruiting pedicels 4–9 mm. long. 14. *I. integra*.
- FF. Fruiting pedicels 1–3 mm. long. 15. *I. brachypoda*.
- EE. Fruit small, 4–8 mm. in diameter; pyrenes striate and sulcate; leaves rigid, spiny, when entire rounded at the apex or rarely short acuminate, 1–4 cm. long.
- F. Leaves ovate or quadrangular, those on the fruiting branchlets with 2 or 3 strong spines on each side; fruiting pedicels 2 mm. long; pyrenes 2. 16. *I. bioritsensis*.
- FF. Leaves obovate or elliptic; entire or dimorphous; fruiting pedicels 4–5 mm. long; pyrenes 4.
- G. Leaves dimorphous, those on the fruiting branchlets entire and those on the sprouts sinuate and

- spiny, the entire ones obovate, rounded at the apex. 17. *I. dimorphophylla*.
- GG. Leaves entire, elliptic, obtuse or shortly acuminate at the apex. 18. *I. suzukii*.
- DD. Leaves serrate or crenate.
- E. Fruiting pedicels 2–3 mm. long.
- F. Petioles 4–9 mm. long, 12–22 times shorter than the length of the lamina. 19. *I. formosana*.
- FF. Petioles 8–16 mm. long, 5–12 times shorter than the lamina. 20. *I. ficoidea*.
- EE. Fruiting pedicels (4–) 6–8 (–14) mm. long.
- F. Leaves obovate, rarely elliptic, obtuse, rounded, retuse, rarely broadly and shortly acuminate at the apex; fruiting pedicels 9–14 mm. long. . . 21. *I. liukiuensis*.
- FF. Leaves oblong-elliptic, elliptic or obovate-elliptic, apex acuminate; fruiting pedicels (4–) 6–8 mm. long.
- G. Fruit 10–11 mm. in diameter; leaves shortly and abruptly acuminate, the lateral nerves prominent on both surfaces. 22. *I. uraiensis*.
- GG. Fruit 5–6 mm. in diameter; leaves caudate, the lateral nerves obscure on both surfaces. 23. *I. warburgii*.
- CC. Pyrenes 4, 5, or 6, the endocarp coriaceous or sublignescens; individual branches of the fascicles of the staminate plant usually cymose or umbelliform. Sect. *Pseudoaquifolium*.
- D. Branchlets ridged, in cross-section appearing quadrangular; pyrenes 6, 3-striate and 2-sulcate, the endocarp sublignescens; leaves chartaceous or membranaceous, serrate or subentire, pubescent on both surfaces. 24. *I. pubescens*.
- DD. Branchlets subterete; pyrenes 4 or 5, smooth, the endocarp coriaceous; leaves entire, coriaceous, glabrous.
- E. Leaves 9–16 cm. long, punctate beneath; fruit with a columnar-mammiform stigma; pyrenes smooth. 25. *I. cochinchinensis*.
- EE. Leaves 2–5 cm. long, epunctate, fruit with a capitate or discoid stigma; pyrenes 3-striate.
- F. Leaves suborbicular or broad-elliptic, the apex shortly produced, usually retuse; individual branches of the inflorescence 1- or 3-flowered. 26. *I. goshiensis*.
- FF. Leaves ovate-elliptic or elliptic, acuminate; individual branches of the inflorescence uniflorous. 27. *I. hayataiana*.
1. *Ilex micrococca* Maxim. in Mém. Acad. Sci. St. Pétersb. VII. 29 (3): 39, *pl. 1*, *fig. 6*. 1881. — S. Y. Hu in Jour. Arnold Arb. 30: 261. 1949.
- Ilex micrococca* var. *longifolia* Hayata, Ic. Pl. Form. 3: 55, *pl. 9*. 1913, et Ic. Pl. Form. 6 (Suppl.): 13. (Gen. Ind. Fl. Form. 13). 1917. — Ito, Taiwan Shokub. Zus. *fig. 488*. 1928. — Sasaki, Cat. Gov. Herb. 317. 1930. — Suzuki in Masamune, Short Fl. Form. 125. 1936.
- Hayata differentiated his variety by the “much narrower leaves with acute or obtuse base which is never rounded as is the case with the type.”

The base of the leaf in this species varies according to the position of the leaf on the branchlet. The leaves on the lower part of the branchlet have a broader base, which appears rounded, and those on the apical portions have a narrower base which is obtuse or acute. Such variations occur on specimens collected in Japan and China as well as on those from Taiwan. Moreover, the Taiwan specimens that I have examined appear to be identical with Hayata's type (photograph) of this variety, *N. Konishi*, Aug. 1906, from Uraisha. All these specimens agree with the Chinese and Japanese material in the size, texture, and margin of the leaves, in the inflorescence, and in the characters relating to the fruit and pyrenes. I see no reason for maintaining this Taiwan variety.

In Taiwan, *Ilex micrococca* occurs only in the northern and west-central parts of the island. It has been recorded from Sozan, Toyen, Uraisha, the mountains Daiton, Taihei and Gosi, and Lake Jitugetutan. It is a common tree in the woods, growing to a considerable height (up to 23 meters). In the whole family there is no species that equals *I. micrococca* in the length of its fruiting peduncles and in the large number of fruits in each infructescence. For this reason, this species is well worthy of introduction into southern American gardens for the fruiting branches.

The chartaceous leaves, the conspicuous lenticels on the current year's growth, and the occasional occurrence of abbreviated shoots in this species suggests its relationship with *I. macrocarpa* Oliv., a deciduous species. Of all the specimens that I have examined, I have not seen any with leaves on the second year's growth. For this reason I have placed the species in the subgenus *Prinos*. Field data for the winter habit of the species are needed. When such data are available, it may prove necessary to change the subgeneric status of this species.

2. *Ilex kusanoi* Hayata in Jour. Coll. Sci. Tokyo 30: 55 (Mat. Fl. Form. 55). 1911; Ic. Pl. Form. 1: 132. 1911, et 6 (Suppl.): 13 (Gen. Ind. Fl. Form. 13). 1917. — Kanehira, Form. Trees 123. 1917, rev. ed. 375, fig. 331. 1936. — Sasaki in Trans. Nat. Hist. Soc. Form. 18: 330, 1928, et Cat. Gov. Herb. 317. 1930. — Suzuki in Masamune, Short Fl. Form. 125. 1936. — Sonohara et al., Fl. Okinawa 92. 1952.

Ilex taiwaniana Hayata in Jour. Coll. Sci. Univ. Tokyo 30: 58 (Mat. Fl. Form. 58). 1911; Ic. Pl. Form. 1: 135. 1911, et 6 (Suppl.): 13 (Gen. Ind. Fl. Form. 13). 1917. — Kanehira, Form. Trees 127. 1917.

Ilex poneantha Koidzumi, Pl. Nov. Amami-Ohsim. 13. 1928, syn. nov.

Deciduous tree (?), entirely glabrous, with both elongated and abbreviated shoots; second year's growth of the elongated shoot 3–5 mm. in diameter, when dry castaneous, shiny, with conspicuous lenticels, the current year's growth subterete, up to 20 cm. long, 2 mm. in diameter; abbreviated shoots 1 cm. long, 2.5 mm. in diameter, rugose with leaf-scars and scars of the pedicels, bearing 1–4 leaves, 3–13 flowers. Leaves 6–15 mm. apart on elongated shoots, fasciculate at the end of abbreviated shoots; stipules minute, broadly deltoid; petioles 5–8, rarely up to 10 mm. long,

one tenth up to one sixth the length of the lamina, the distal portion winged with decurrent leaf-base, canaliculate above; lamina chartaceous, olivaceous, ovate, 4–6.5 cm. long, 2.5–4 cm. wide, acute at the base, obtuse or shortly broad-acuminate at the apex, remotely crenulate-serrate, the midrib slightly impressed above, prominent beneath, the lateral nerves 5–7 pairs, obscure above, evident beneath, with reticulation obvious beneath. Inflorescence fasciculate, in the axils of scales or small leaves at the base of the elongated shoots or at the apex of the abbreviated ones. Staminate flowers solitary or in a simple 3-flowered cyme, peduncles 3 mm. long, pedicels 3–4 mm. long, prophyllus basal, ciliate; calyx patelliform, 4- up to 6-lobed, the lobes ovate, erose, ciliate; corolla 10 mm. across, the petals oblong, 4 mm. long, 2.5 mm. wide, connate at the base; stamens shorter than the petals, the anthers oblong; rudimentary ovary pulvinate, depressed at the center. Pistillate flowers 3 in each fascicle, the pedicels 12–17 mm. long; calyx patelliform, 2.5 mm. across, with 5 or 6 lobes, the lobes rounded and ciliate; corolla rotate, 5 mm. across, connate at the base, the lobes ovate, 2 mm. long, 1.5 mm. wide; staminodes two thirds the length of the corolla, the sterile anthers sagittate; ovary globose, 1 mm. in diameter, the stigma mammiform. Fruit not seen.

TAIWAN: Taito, *S. Kusano* 8, July 1908 (photograph of the TYPE); Kashioto [Kwasyoto], *G. Nakahara* 1025 (photograph of TYPE of *Ilex taiwaniana* Hayata). BOTEL TOBAGO: Kotosyo [Kotosho], *S. Sasaki*, Feb. 7, 1920.

LIUKIU ISLANDS: Amami-Oshima, *J. Ohba* 171 (LECTOTYPE of *Ilex poneantha* Koidz., photograph and fragments).

Ilex kusanoi Hayata is closely related to *Ilex macropoda* Miq., but the latter species has relatively longer petioles, puberulent leaves, solitary pistillate flowers with the pedicels 6–7 mm. long, and uniflorous individual staminate flowers in small fascicles. Hayata distinguished this species from his *I. taiwaniana* by its "much thinner" leaves, but in his descriptions for both species he used the same term, "chartaceo-membranacea." As the types of these two binomials were collected at different seasons, there may be a reason for the difference in the texture of the leaves. The fragment of the type of *Ilex poneantha* Koidz., kindly supplied by Dr. S. Kitamura of Kyoto, Japan, represents a staminate plant of *Ilex kusanoi* Hayata.

3. *Ilex asprella* (Hook & Arn.) Champ. ex Benth. in Hook Jour. Bot. Kew Gard. Misc. 4: 329. 1852. — Henry in Trans. As. Soc. Jap. 24 (Suppl.): 26 (List Pl. Form. 26). 1896. — Mat. & Hayata, Enum. Pl. Form. 81. 1906. — Ito, Taiwan Shokub. Zus. fig. 486. 1928. — Sasaki, Cat. Gov. Herb. 316. 1930. — Suzuki in Masamune, Short Fl. Form. 124. 1936. — S. Y. Hu in Jour. Arnold Arb. 30: 269. 1949.

TAIWAN: Taipei, *H. Keng* 1024.

This species is widely distributed in the warm temperate, subtropical, and tropical regions on the mainland of China and on Taiwan, and extends southward to northern Luzon in the Philippines. In Taiwan it has been

reported from the mountains Daiton, Gosizan and Sozan, and from Toyen of Taihoku prefecture in the north, Nanto of Taichu prefecture in the west, Karenko [Kwarenko] and Taito of the east coast, South Cape at the southern extremity, and Mt. Niitaka in the center of the island. It is a common shrub about three meters high with a trunk up to 6 cm. in diameter, occurring in thickets and along roadsides from sea level up to 1000 meters altitude. Its white flowers appear in early March or April. The fasciculate staminate flowers, the solitary long-pedicellate pistillate flower, the globose fruit with evident style and capitate stigma, and the striate pyrenes suggest close relationship with *Ilex longipes* Chapm. of southeastern North America, which ranges from Florida to Alabama and Tennessee. These species of *Ilex* provide another proof of the affinities of the floras of eastern Asia and eastern North America.

4. *Ilex lonicerifolia* Hayata, Icon. Pl. Form. 3: 54, *pl.* 8. 1913, et 6 (Suppl.): 13 (Gen. Ind. Fl. Form. 13). 1917. — Sasaki, Cat. Gov. Herb. 317. 1930. — Suzuki in Masamune, Short Fl. Form. 125. 1936. — S. Y. Hu in Jour. Arnold Arb. 30: 290. 1949.

The range of this species is limited to a narrow band across the center of Taiwan, Lat. $23^{\circ} 50' - 24^{\circ} 20' N$. The type material was collected from Pokupokusha, Kwarenko, on the east coast. Additional specimens have been collected from Mt. Daisetu and from Nanto and Lake Candidius (Jitugetutan) of Taichu prefecture, at an altitude of 750 meters. The plant has been reported as a tree up to 17 meters high. It flowers in May. The mature fruits are red. It can be readily recognized by its pubescent entire leaves, cymose inflorescences, medium-sized ovoid-globose fruits, and smooth pyrenes which are shallowly concave on the back.

- 4a. *Ilex lonicerifolia* var. *hakkuensis* (Yamamoto) S. Y. Hu in Jour. Arnold Arb. 30: 291. 1949.

Ilex hakkuensis Yamamoto Suppl. Ic. Pl. Form. 1: 32, *fig.* 14. 1925. — Sasaki, Cat. Gov. Herb. 316. 1930. — Suzuki in Masamune, Short Fl. Form. 125. 1936.

This glabrous variety was first collected at Hakku by B. Hayata in April 1916. Material of this variety has also been collected from Rengeti and Lake Jitugetutan of Taichu prefecture.

5. *Ilex matsudai* Yamamoto Suppl. Ic. Pl. Form. 1: 37, *fig.* 17. 1925. — Sasaki, Cat. Gov. Herb. 317. 1930. — Kanehira, Form. Trees 377, *fig.* 333. 1936.

Ilex lonicerifolia Hayata var. *matsudai* Yamamoto in Jour. Trop. Agr. 5: 55. 1933. Syn. nov.

An evergreen tree, entirely glabrous; the third and second years' growth 3–4 mm. in diameter, more or less rugose with numerous conspicuous lenticels, the current year's growth 2 mm. in diameter, longitudinally

striate, the terminal buds ovoid, with glabrous and ciliate scales. Leaves occurring even on the third year's growth, 1–2 cm. apart, the stipules obscure; petioles 8–15 mm. long, rugose, canaliculate above; lamina subcoriaceous, olivaceous and brown, slightly shiny above, opaque beneath, oblong-elliptic, the lower ones often broad-elliptic or suborbicular, 4–9.5 cm. long, 2.5–4 cm. wide, acute or rarely obtuse at the base, very shortly broad-acuminate, rarely obtuse at the apex, the acumen 3–5 mm. long, almost as wide; margin entire, more or less recurved when dry; midrib plane above, elevated beneath, the principal lateral nerves 9–11 pairs, obscure above, elevated beneath, reticulate near the margin. Flowers not known. Infructescence cymose, solitary, in the axils of the leaves on the current year's growth, with 3 fruits, the peduncles 3–11 mm. long, dorsoventrally compressed, glabrous; pedicels 5 mm. long, very minutely puberulent at the base. Fruit ellipsoid, 8–10 mm. long, 6–8 mm. in diameter, the persistent calyx explanate, 4 mm. in diameter, with 5 or 6 rounded, ciliate lobes, the stigma discoid. Pyrenes 4 or 5, smooth, 8 mm. long, 2–5 mm. wide on the back, dorsally deeply and widely unicanalicate, in cross-section U-shaped, the endocarp sublignescens.

TAIWAN: Koshun [Kosyun], Mt. Hiiran, *E. Matsuda* in 1919 (photo and fragment of TYPE); same locality, *K. Yamada* 47.

The evergreen entire leaves, the cymose infructescence, and the deeply unicanalicate pyrenes of this species suggest a close relationship with *Ilex maculurei* Merr. of Kwangtung and northern Indo-China. Both of them are tropical species, but the latter can be distinguished by its large and thicker leaves and the compound cymose inflorescence.

6. *Ilex rotunda* Thunb., Fl. Jap. 77. 1784. — Henry in Trans. As. Soc. Jap. 24 (Suppl.): 27 (List Pl. Form 27). 1896. — Mat. & Hayata, Enum. Pl. Form. 82. 1906. — Sasaki, Cat. Gov. Herb. 318. 1930. — Ito, Taiwan Shokub. Zus. fig. 487. 1928. — Suzuki in Masamune, Short Fl. Form. 126. 1936. — S. Y. Hu in Jour. Arnold Arb. 30: 308. 1949.

Ilex koshunensis Yamamoto, Suppl. Ic. Pl. Form. 1: 36, fig. 16. 1925. — Suzuki in Masamune, Short Fl. Form. 125. 1936.

Ilex sasakii Yamamoto, op. cit. 1: 39, fig. 19. 1925. — Sasaki, Cat. Gov. Herb. 318. 1930. — Suzuki, op. cit. 126. 1936.

TAIWAN: Toyen, Kayahara, *Hayata & Sasaki* (photograph of TYPE of *Ilex sasakii* Yamamoto); Koshun, Botansha, *Nakahara* 941 (photograph of TYPE of *Ilex koshunensis* Yamamoto).

LIUKIU ISLANDS: Amami-Oshima, *Y. Hosoyamada*, July 29, 1927; without precise locality, *C. Wright* 184 (G).

This is the most widely distributed species of *Ilex* in eastern Asia, ranging from Korea and Japan southward to the Liukiu Islands, Taiwan, and the mainland of China and Indo-China. In Taiwan it occurs on the mountains of Horan, Sitisei, and Taihei, and at Toyen, Sirin, and Sitiku of the

Taihoku prefecture, at Suwo of the Giran prefecture, Nanto, Mt. Noko, and Lake Candidius of the Taichu prefecture, Daibu of the Taito prefecture, and Koshun (Kosyun) of Tainan prefecture. It has been reported as a bush three meters high, as well as a tree of ten meters. The scarlet fruit matures in November.

The differences in the climatic and edaphic conditions prevailing in the large area covered by the wide range of the species naturally induce variations in the size, shape, and texture of the leaves. As to the Taiwan material, several binomials have been given to the various collections. As the types of these species are compared with a very large number of specimens from the extensive range of the species, many intergrades are noted. Thus with specimens from widely separated regions, the characters employed to separate Thunberg's from the more recently published species become insignificant and cease to be of value even for distinguishing varieties.

- 6a. *Ilex rotunda* Thunb. var. *microcarpa* (Lindl. ex Paxt.) S. Y. Hu in Jour. Arnold Arb. 30: 310. 1949.

Ilex microcarpa Lindl. ex Paxt. in Fl. Gard. 1: 43. 1850.

In Taiwan this variety occurs in the northern and west-central parts of the island. It differs from typical *Ilex rotunda* Thunb. in the puberulous inflorescence. The fruit of this variety is red. Masamune in 1935 described a yellow-fruited variety, *Ilex rotunda* Thunb. var. *sinensis* (Trans. Nat. Hist. Soc. Form 25: 13) from Hongkong and Nanhoi district in Kwangtung province. As it also has puberulous inflorescences, its relationship is probably closer to this variety than to the typical *Ilex rotunda* Thunb. There is a possibility that Masamune may have observed immature fruits.

7. *Ilex tugitakayamensis* Sasaki in Trans. Nat. Hist. Soc. Form. 21: 153, fig. 3. 1931. — Suzuki in Masamune, Short Fl. Form. 126. 1936. — S. Y. Hu in Jour. Arnold Arb. 30: 288. 1949.

This unique species with its subcapitate umbelliform infructescence is known only from the type collection. It grows on Mt. Tugitaka. It has a peculiar position in the classification of the units of the section to which it belongs. As the fruiting pedicels all originate from the enlarged end of the peduncle, the inflorescence is umbelliform, and the species should belong to the Series *Umbelliformes* (Loes.) S. Y. Hu. But species of that series all possess three striate and two sulcate pyrenes, while the pyrenes of this species are smooth, coriaceous, and flattened or slightly concave on the back. In this section such pyrenes are found only in representatives of the Series *Chinenses* S. Y. Hu. More material is needed for the clarification of the taxonomic position of this species. Its coriaceous entire leaves and the much reduced fruiting pedicels suggest a relationship with *Ilex lancilimba* Merr. of Hainan Island. Future students may find it desirable to segregate these species in a distinct series of the Section *Lioprinus* (Loes.) S. Y. Hu.

8. *Ilex pedunculosa* Miq. in Versl. Med. Kon. Akad. Wet. II, 2: 83. 1868 [1866] (Repr. 19. 1866), et in Ann. Mus. Bot. Lugd.-Bat. 3: 106. 1867. — S. Y. Hu in Jour. Arnold Arb. 30: 334. 1949.

Ilex morii Yamamoto, Suppl. Ic. Pl. Form. 1: 38, fig. 18. 1925. — Suzuki in Masamune, Short Fl. Form. 125. 1936.

Ilex impressivena Yamamoto, l.c. 34, fig. 15. 1925. — Sasaki, Cat. Gov. Herb. 317. 1930. — Suzuki, l.c.

TAIWAN: The Central Mountain Range, *U. Mori*, Dec. 1908 (photograph of TYPE of *I. morii* Yamamoto); Taichu, Nanto, Saramao, *E. Matsuda*, Aug. 11, 1919 (photograph of TYPE of *I. impressivena* Yamamoto).

Yamamoto published two species from central Taiwan. He distinguished *I. morii* from *I. pedunculosa* Miq. by its smaller leaves and *I. impressivena* by the impressed midribs of the leaves. These variations also occur in specimens collected in China and Japan. After a comparative study of the Taiwan, Chinese, and Japanese specimens, I can only conclude that the two Formosan forms are conspecific with Miquel's species. In Taiwan, the species occurs in the west-central part of the island. The white flowers appear in August.

- 8a. *Ilex pedunculosa* Miq. var. *taiwanensis* S. Y. Hu in Jour. Arnold Arb. 30: 336. 1949.

This is a small-leaved form endemic to northern Taiwan. The small white flowers appear in July. The small size and the brunneous-nigrescent color of the dried leaves of this variety remind one of *Ilex sugeroki* Maxim. var. *brevipedunculata* (Maxim.) S. Y. Hu, but the latter has much shorter petioles.

9. *Ilex yunnanensis* Franch. var. *parvifolia* (Hayata) S. Y. Hu in Jour. Arnold Arb. 30: 341. 1949.

Ilex parvifolia Hayata in Jour. Coll. Sci. Univ. Tokyo 30: 57 (Mat. Fl. Form. 57). 1911; Ic. Pl. Form. 1: 134, fig. 19. 1911, et 6 (Suppl.): 13 (Gen. Ind. Fl. Form. 13). 1917. — Sasaki, Cat. Gov. Herb. 318. 1930. — Suzuki in Masamune, Short Fl. Form. 125. 1936.

Ilex transarisanensis Hayata ex Kanehira, For. Trees 127. 1917.

This is a high mountain form. In Taiwan it occurs at altitudes of 2500–3300 meters in the central and southwestern parts of the island. It is common along the edges of the forests between Mt. Arisan and Mt. Niitaka. A compact shrub, 1.5–5 meters high, with shiny dark green foliage, it bears white flowers in June and bright red berries from November to February. It should be an excellent species for foundation plantings, low screens, or hedges.

10. *Ilex sugeroki* Maxim. var. *brevipedunculata* (Maxim.) S. Y. Hu in Jour. Arnold Arb. 30: 343. 1949.

Ilex sugeroki Maxim. forma *brevipedunculata* Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29 (3): 36, pl. 1, fig. d. 1881.

Ilex taisanensis Hayata in Jour. Coll. Sci. Univ. Tokyo 30: 57 (Mat. Fl. Form. 57). 1911; in Ic. Pl. Form. 1: 134. 1911, et 6 (Suppl.): 13 (Gen. Ind. Fl. Form. 13). 1917. — Sasaki, Cat. Gov. Herb. 318. 1930. — Suzuki in Masamune, Short Fl. Form. 126. 1936.

This variety occurs on the northwestern slopes of the Central Mountain Range, at Hori and Bioritu [Byoritu]. The few specimens that I have examined do not have the characteristic olivaceous or brown shiny leaves of the dried Japanese material. This may be due to the technique used in their preparation.

11. *Ilex maximowicziana* Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 339 (Monog. Aquif. 1: 339). 1901. — Sonohara et al., Fl. Okinawa 92. 1952.

Ilex crenata sensu Ito & Matsum. in Jour. Coll. Sci. Tokyo 13: 367 (Tent. Fl. Lutch. 367). 1900, non Thunb. 1784.

Ilex crenata Thunb. var. *scoriatum* Yamamoto, Suppl. Ic. Form. 1: 31. 1925, non var. *scoriarum* W. W. Smith. 1917.

Ilex scoriatulum Koidzumi in Bot. Mag. Tokyo 43: 389. 1929. — Sasaki, Cat. Gov. Herb. 318. 1930. — Kanehira, Form. Trees, rev. ed. 381, fig. 338. 1936 (*I. scoriatum*). — Suzuki in Masamune, Short Fl. Form. 126. 1936.

An evergreen tree 3 m. high with a trunk 4 cm. in diameter; branchlets longitudinally ridged, the third year's growth 3 mm. in diameter, the lenticels obscure, the current year's growth 1.5 mm. in diameter, subquadrangular, very minutely puberulous, the terminal buds usually well developed, subconic, puberulent. Leaves occurring also on the second year's growth, 3–10 mm. apart, the stipules aciculate, 0.7 mm. long, persistent; petioles 7–10 mm. long, one third or one fourth the length of the lamina, puberulous, deeply grooved above; lamina coriaceous, olivaceous, shiny above, opaque and punctate beneath, elliptic or broad-elliptic, 2–4.5 cm. long, 1.3–2.3 cm. wide (up to 8 cm. long and 3.4 cm. wide, according to Loesener), acute at both ends, rarely the lower ones obtuse or rounded at the apex; evenly crenulate-serrate at the margin; midrib impressed above, elevated beneath, the lateral nerves obscure on both surfaces. Staminate inflorescences fasciculate, the individual branches 1- or 3-flowered, the flowers white, 4-merous; the calyx patelliform, the corolla rotate, the stamens shorter than the petals, with oblong anthers, the rudimentary ovary subglobose, with a rostellate center. Pistillate inflorescence solitary in the axils of small leaves or scales on the lower portion of the current year's growth; pedicels 7 mm. long, the flowers not known. Fruit globose, 8 mm. in diameter, the persistent calyx 3.5 mm. in diameter, 4-lobed, the lobes rounded, ciliate; the stigma discoid. Pyrenes 4 in number, 5 mm. long, 4 mm. wide, the endocarp coriaceous, smooth, 5-striate, the striae impressed.

TAIWAN: Taito, Taririku-sya, S. Sasaki in May 1924 (photograph).

LIUKIU ISLANDS: Ishigaki, J. L. Gressitt 608 (TOPOTYPE). Irumuti, S. Kawagoe on July 27, 1919.

Ilex maximowicziana was based on the collections of Warburg and Tashiro from Ishigaki. The species has been overlooked by botanists interested in the flora of Taiwan and the Liukiu Islands. In 1925 Yamamoto interpreted the collections of Soma, Matsuda, and Sasaki from Taiwan, and Tashiro's collection (type material for *Ilex maximowicziana* Loes.) from Liukiu as *Ilex crenata* Thunb. var. *scoriarum* (*scoriatum*) W. W. Smith. In 1929 Koidzumi, presumably on the basis of the same collections cited by Yamamoto, raised the variety to specific rank, and not realizing that there was an earlier valid name for the Liukiu plant, called it *Ilex scoriatulum*.

This species is very closely related to *Ilex viridis* Champ. ex Benth. The differences between them rest on very minute and technical characters. In *I. maximowicziana* the petioles are relatively longer, equalling one third or one fourth the length of the lamina, and the pyrenes are smooth with impressed striae, while in *Ilex viridis* the petioles are relatively shorter, being one thirteenth to one sixth the length of the lamina, and the pyrenes are rugose with slightly elevated striae. The insular taxon is not well known. More material from Taiwan and the Liukiu Islands may prove it to be conspecific with the mainland form. In Taiwan, this species occurs at the southern end of the island.

12. *Ilex mutchagara* Makino, in Bot. Mag. Tokyo 27: 75. 1913. — Sasaki, Cat. Gov. Herb. 318. 1930, pro parte. — Sonohara et al., Fl. Okinawa 92. 1952.

An evergreen shrub up to 3 m. high, glabrous, the branchlets subquadangular, deeply grooved, the third year's growth 1.5–2 mm. in diameter, the lenticels lacking, the leaf-scars semicircular, very slightly elevated; current year's growth 1 mm. in diameter, the terminal buds weakly developed. Leaves occurring also on the second year's growth, 2–5 mm. apart; the stipules callose, deltoid, 0.5 mm. long; petioles 3–6 mm. long, up to one eighth the length of the lamina, deeply narrow-grooved above. Lamina subcoriaceous, olivaceous, shiny above, opaque and punctate beneath, oblanceolate or obovate-elliptic, (2–) 4–5 cm. long, 1–1.5 cm (rarely up to 1.8 cm.) wide, cuneate at the base, shortly and broadly acuminate or rarely rounded at the apex, the acumen obtuse at the tip, remotely crenulate-serrate on the anterior half; midrib impressed above, elevated beneath, the lateral nerves obscure on both surfaces. Staminate inflorescence fasciculate, the individual branches 3- or 1-flowered, the peduncles 3–7 mm. long, minutely puberulent, the pedicels 2–3.5 mm. long, subpuberulent, the flowers 4-merous; calyx patelliform, the lobes suborbicular, ciliate; corolla rotate, the petals broad-elliptic, the stamens with ellipsoid anthers; the rudimentary ovary minute. Pistillate flowers not known. Fruit solitary, in the axils of the bracts at the base of the current year's growth, the pedicels with 2 prophylla at the middle, the berries globose, 7–8 mm. in diameter, the persistent calyx explanate, 3 mm. across, the lobes rounded, sparsely ciliate, the stigma thickly discoid. Pyrenes 4, smooth, 5 mm. long, the endocarp coriaceous.

LIUKIU ISLANDS: Okinawa, Nago, *E. H. Wilson* 8071.

Makino based his description chiefly on material collected from Okinawa, principally from Nago. Wilson's collection appears to have come from the type locality. Makino also cited material from Kume and Iriomote. Specimens from these islands belonging to this species have not been available for my examination.

As Makino observed, this species is closely allied to *Ilex crenata* Thunb. The oblanceolate, loosely arranged leaves and glabrous branchlets are very distinct. It is endemic to the Liukiu Islands, where it is rare even at the type locality. Its white flowers appear in February.

13. *Ilex triflora* Blume var. *kanehirai* (Yamamoto) S. Y. Hu in Jour. Arnold Arb. 30: 332. 1949.

Ilex crenata Thunb. var. *kanehirai* Yamamoto, Suppl. Ic. Pl. Form. 1: 31, fig. 11. 1925.

Ilex kanehirai (Yamamoto) Koidz. in Bot. Mag. Tokyo 43: 389. 1929. — Sasaki, Cat. Gov. Herb. 317. 1930. — Kanehira, Form. Trees, rev. ed. 375. 1936. — Suzuki in Masamune, Short Fl. Form. 125. 1936.

Ilex mutchagara Makino var. *kanehirai* (Yamamoto) Masamune in Trans. Nat. Hist. Soc. Form. 25: 253. 1935. — Kanehira & Hatusima in Trans. Nat. Hist. Soc. Form. 29: 156. 1939. — Sonohara et al., Fl. Okinawa 92. 1952.

Regarding the status of this taxon, there is considerable controversy among botanists. Yamamoto first placed it as a variety of *Ilex crenata* Thunb. Koidzumi in 1929 raised it to specific rank, and both Kanehira and Sasaki agreed with him. Masamune maintained it as a variety of *Ilex mutchagara* Makino. Kanehira also adopted this concept. *Ilex mutchagara* Makino is characterized by oblanceolate leaves with a shortly acuminate apex and solitary fruits. The present species has fasciculate fruits and obovate leaves with rounded apex. Its relationship should be closer to *Ilex triflora* Blume, a species with fasciculate fruits, which is widely spread in China.

This variety was first described from Giran in northeastern Taiwan. Additional material has since been collected from Kosyun at the southern extremity of the island. It also occurs on the island of Hainan and in Fukien Province of the Chinese mainland.

14. *Ilex integra* Thunb., Fl. Jap. 77. 1784. — Sieb. & Zucc. in Abh. Bay. Ak. Wiss. Math. Phys. 4 (2): 148 (Fl. Jap. 1: 40). 1845. — Maxim. in Mém. Acad. Sci. St. Pétersb. VII, 29 (3): 28, 41, pl. 1, fig. 3. 1881. — Forbes & Hemsl. in Jour. Linn. Soc. Bot. 23: 116. 1886. — Ito & Matsum. in Jour. Coll. Sci. Univ. Tokyo 12: 368. 1900. — Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 270 (Monog. Aquif. 1: 270). 1901. — Matsum. & Hayata, Enum. Pl. Form. 82. 1906. — Sasaki, Cat. Gov. Herb. Form. 317. 1930. — Suzuki in Masamune, Short Fl. Form. 125. 1936. — Rehder, Man. Cult. Trees and Shrubs,

ed. 2, 548. 1940; Bibliogr. Cult. Trees and Shrubs 400. 1949. — Sonohara et al., Fl. Okinawa 92. 1952.

Othera japonica Thunb. (praes., resp. Lodin), Nov. Gen. Pl. 56. 1783.

Ilex othera Sprengel, Syst. Veg. 1: 496. 1826.

Ilex asiatica Sprengel, l.c.

Prinos integra Hook. & Arn. in Bot. Beechey Voy. 261. 1853.

Small evergreen trees 5–8 m. high, the trunk 12–20 cm. in diameter, glabrous; branchlets subterete, striate, the third year's growth 3–4 mm. in diameter, the lenticels lacking, the leaf-scars suborbicular, conspicuous, the current year's growth 2–3 mm. in diameter, the terminal buds well developed, conic, glabrous. Leaves occurring also on second year's growth, 3–15 mm. apart, the stipules obscure; petioles 1–1.5 cm. long, up to one third the length of the lamina, narrowly canaliculate above; lamina coriaceous, olivaceous and brunnescens, obovate to obovate-elliptic, rarely oblanceolate, 4–7 cm. long, 1.5–2.5 cm. wide, cuneate, rarely obtuse at the base, abruptly short-acuminate, the acumen 5 mm. long, entire, the midrib plane above, evident beneath, the lateral nerves 6–9 pairs, obscure, rarely evident on both surfaces. Inflorescence fasciculate, the flowers 4-merous, the individual branches of the fascicles uniflorous. Staminate inflorescence: pedicels 4–5 mm. long, glabrous, bracts ovate, glabrous, ciliate, the prophylla basal, ciliate; calyx patelliform, 4 mm. across, the lobes ovate, 1.75 mm. long, obtuse and ciliate; corolla rotate, 10–11 mm. across, the petals oblong, 5 mm. long, 2 mm. wide, connate at the base; stamens shorter than the petals, the anthers oblong; rudimentary ovary globose, slightly depressed, often 4-lobed at the apex. Pistillate inflorescence: pedicels 6–8 mm. long, bracts ovate, the prophylla 2, basal, ciliate; calyx patelliform, 3 mm. across, the lobes rounded; corolla erect, the petals obovate, 5 mm. long, 3.5 mm. wide, the apex rounded, ciliate; staminodes shorter than the petals, the sterile anthers minute, cordate; ovary ovoid, 4 mm. long, 3.5 mm. wide, the apex flat with discoid stigma. Fruit large, globose or oblong-ellipsoid, 9–19 mm. long, 10 mm. in diameter, the exocarp thick, the stigma discoid. Pyrenes rugose, striate and sulcate, the back oblong in outline, 7–10 mm. long, 4 mm. wide, slightly depressed along the middle, the endocarp stony.

LIUKIU ISLANDS: Okinawa, Kunigami, *E. H. Walker*, *S. Sonohara*, *S. Tawada* & *T. Amano* 7005; same locality, *S. Sonohara*, *S. Tawada* & *T. Amano* 6309. Nakano-shima, Linshoten Isl. Group, *S. Kawagoe*, Aug. 20, 1912.

JAPAN: Hondo: Tokyo, *E. Elliott* 7; *M. Mizushima* 1088. Sagami, *M. & U. Mizushima* 911; *K. Miyabe*, April 1882; *K. Sakurai*, April 12, 1906. Mino, *K. Shiota* 70, 6542. Yokohama, *Maximowicz* in 1862 (G); *E. H. Wilson* 6415. Kamakura, *E. H. Wilson* 6608, 6609. Nagasaki, *Oldham*. Without precise locality, *Herb. Thunberg*, fragment of type material; *Siebold* ex *Herb. Lugduno-Batavo* 101570 (A, G); *Zollinger*. Kyushu: Tanega-shima, *E. H. Wilson* 6134. Kago-shima, *E. H. Wilson* 6167.

KOREA: Quelpaert, *U. Faurie* 1638, 1639, 1647; *T. Taquet* 622, 623, 2718, 2719, 4146; *E. H. Wilson* 9513. Oo-ryong-too, *E. H. Wilson* 8540. Port Hamilton, *C. Wilford* in 1859 (G).

I have also examined material cultivated in Japan, the Royal Botanic Gardens at Kew, the Golden Gate Park, San Francisco, and in gardens in Augusta, Ga., and Federal Point, Fla. In Japan the tree is widely cultivated for ornamental purposes. The young leaves are eaten as greens. The bark is ground to obtain a sticky substance which is used for bird-lime. Loesener recorded this species from China, as represented by *Fortune* 57. Among all the Chinese material of *Ilex* that I have examined, there is no element that is close to this species, and it appears that any occurrence of it in China is not spontaneous.

There exists a great variation in leaf-shape and pedicel-length. The pedicels of all the Liukiu material that I have examined are on the short end of the normal curve. They are 6–7 mm. long. Among the Japanese and Korean elements there is a long-pedicellate form. The fruiting pedicels are as long as 10–15 mm. In such cases the prophylla are inserted on the pedicels, about one third of the way from the base.

15. *Ilex brachypoda* sp. nov.

Frutex sempervirens, usque 3 m. altus, ramulis glaberrimis, bienniis 4 mm. diametro, teretis, rugosis, lenticellis obsoletis; foliis coriaceis, integerrimis, obovatis, vel oblongo-obovatis, 3–8 cm. longis, 1.5–4.5 cm. latis, basi acutis vel cuneatis, apice obtusis vel breviter acuminatis, costa supra plana, subtus prominula, nervis lateralibus utrinque 5 vel 6, obscuris; inflorescentiis paucifasciculatis, floribus 4-meris; ♂ ignotis; ♀ unifloris, pedicellis 2–3 mm. longis, prophyllis basalibus, ciliatis; calycibus patelliformibus, 4 mm. diametro, lobis ciliatis; corolla erecto-patenti, petalis liberis, ovatis, 4 mm. longis, 3 mm. latis; staminodiis petalis brevioribus, antheris parvis, cordiformibus, ovario magno, ovoideo, 4–5 mm. longo, 3–4 mm. diametro, stigmatate discoideo. Fructus globosus, 10 mm. diametro, stigmatate umbilicato; pyrenis 4, rugosis et lapidosis, dorso 8 mm. longis et 4 mm. latis, leviter depressis.

LIUKIU ISLANDS: Okinawa, Genka, Mt. Kunchon, *E. H. Wilson* 8118. Oosima, *C. Wright*, US 15798 (US, TYPE).

According to Wilson this is a common shrub in Okinawa. Its white flowers appear in early March. It is closely related to *Ilex integra* Thunb., from which it can be distinguished at once by its subsessile fruits.

16. *Ilex bioritsensis* Hayata in Jour. Coll. Sci. Univ. Tokyo 30: 53. 1911. — Sasaki, Cat. Gov. Herb. 316. 1930. — Suzuki in Masamune, Short Fl. Form. 124. 1936. — S. Y. Hu in Jour. Arnold Arb. 30: 366. 1949.

This species is characterized by its small spinose leaves and paired fruits, each with two pyrenes. It was first recorded from Bioritsu [Byoritu], on Mt. Tokuzyo-taizan. Additional material has been collected from Tonbara of Nanto in Taichu prefecture and Mt. Noko of Taito prefecture. It is

now also known from central and western China in mixed forests at altitudes of 1700–3960 meters. In Taiwan it grows to be a small tree up to seven meters high. As a result of repeated cutting for firewood, it is often seen as a shrub about two meters high. Its compact shiny evergreen foliage and its brilliant red fruits make it a good garden specimen.

17. *Ilex dimorphophylla* Koidzumi, Pl. Nov. Amami-Ohsim. 12. 1928.

An evergreen shrub, the old twigs light gray, slightly rugose, the current year's growth pilose. Leaves occurring also on the third year's growth, 4–12 mm. apart, the petioles 0.5–3 mm. long, canaliculate and puberulous above; lamina coriaceous, olivaceous, glabrous, entire or on young shoots 3- to 6-sinuate-dentate on each side, spiny, obovate, obovate-elliptic or broad-elliptic, 1–3.5 cm. long, 7–17 mm. wide, obtuse or rounded at the base, mucronulate-acute to rounded at the apex, the midrib plane above, slightly elevated beneath, the lateral nerves 4 or 5 pairs, obscure on both surfaces. Flowers not known. Infructescence fasciculate, axillary on the second year's growth; pedicels 5 mm. long, puberulous, the prophylla 2, basal, ovate, ciliate; young fruit globose, 3 mm. in diameter, 4-loculate, the stigma 4-lobed discoid, the persistent calyx 2.5 mm. across, 4-lobed, the lobes ovate, rounded at the apex, ciliate. Pyrenes not known.

LIUKIU ISLANDS: Amami-Oshima: Mt. Yuwandake, S. Tashiro in March 1924 (Herb. Univ. Kyoto, LECTOTYPE, photograph and fragment in A); same locality, G. Koidzumi in April 1923 (Herb. Univ. Kyoto, PARATYPE; photograph and fragment in A).

When Koidzumi published this species, he cited three specimens (Z. Tashiro in 1924, H. Ohba in 1925, and G. Koidzumi in 1923), not designating the type. Tashiro's collection represents a four-year-old shoot. The leaves are elliptic, all spiny, and with extremely short petioles. Its appearance reminds one of the Taiwan species *Ilex bioritsensis* Hayata. Koidzumi's collection is a fruiting specimen. Its leaves are all entire and the petioles are 3 mm. long. It resembles a Hongkong species, *Ilex championii* Loes. As leaf-dimorphism is a common feature in many species of *Ilex* (as in the case of *Ilex cornuta* Lindl., where both spiny and entire leaves occur on the same plant), I think that Koidzumi was probably justified in maintaining these heterogeneous elements with entirely different aspects as conspecific. Regarding the typification of this species Dr. S. Kitamura of the Botanical Institute of Kyoto wrote, "I selected the specimens collected by S. Tashiro as the lectotypus. This specimen is sterile. There is Koidzumi's handwriting . . . greater part of his original description coincides well with this specimen. I selected the specimen collected by G. Koidzumi as paratypus."

This species appears to be close to *Ilex goshiensis* Hayata, which has abruptly short-acuminate, retuse, entire leaves 2.8–4.8 cm. long and 1.5–2.5 cm. wide.

18. *Ilex suzukii* S. Y. Hu in Jour. Arnold Arb. 30: 376. 1949.

TAIWAN: Mt. Taiheizan, S. Suzuki, Aug. 7, 1928 (US).

This species is endemic to Mt. Taiheizan, Taihoku, Taiwan. It has a superficial resemblance to *Ilex goshiensis* Hayata because both species have small entire leaves. But the nerves on the leaves of Hayata's species are obscure beneath, the fruits have thick discoid stigmata, and the endocarps of the pyrenes are coriaceous, while the leaves of this species are prominently reticulate beneath, the stigmata of the fruits are navel-like, and the endocarps of the pyrenes are woody. According to the characters presented in the fruit and pyrenes, this species should be placed in Series *Denticulatae* S. Y. Hu of the Section *Aquifolium* Gray. But all the other species in this series have denticulate leaves, while this one has entire ones. More material is awaited for the clarification of its taxonomic position.

19. *Ilex formosana* Maxim in Mém. Acad. Sci. St. Pétersb. VII 29 (3): 46. 1881. — Henry in Trans. As. Soc. Jap. 24 (Suppl.): 27 (List Pl. Form. 27). 1896. — Matsum. & Hayata, Enum. Pl. Form. 81. 1906. — Hayata in Jour. Coll. Sci. Univ. Tokyo 30: 54 (Mat. Fl. Form. 54). 1911, et in Ic. Pl. Form. 1: 131. 1911. — Sasaki, Cat. Gov. Herb. 316. 1930. — Suzuki in Masamune, Short Fl. Form. 125. 1936. — S. Y. Hu in Jour. Arnold Arb. 31: 68. 1950.

This species was based on material collected by Oldham in Taiwan. It has been considered endemic to that island by some botanists, among them Kanehira. The type material has elliptic-lanceolate leaves with obscure reticulation on the lower surface and an acuminate apex, and small fruits on very short (2–3 mm. long) pedicels. As our knowledge of the flora of mainland China increases, we know that a species so characterized is widespread in the warmer regions of China. In Taiwan it occurs in forests at altitudes of 600–700 meters, where it grows to a tree up to twelve meters high. The red fruits remain on the tree throughout the winter, from December to March.

20. *Ilex ficoidea* Hemsl. in Jour. Linn. Soc. Bot. 23: 116. 1886. — S. Y. Hu in Jour. Arnold Arb. 31: 72. 1950.

Ilex buergeri Miq. var. *glabra* Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 89: 286 (Monog. Aquif. 2: 286). 1908.

Ilex glomeratiflora Hayata, Ic. Pl. Form. 3: 53. 1911; 5: 15, fig. 6. 1915, et 6 (Suppl.): 13 (Gen. Ind. Fl. Form. 13). 1917. — Yamamoto, Suppl. Ic. Pl. Form. 1: 32. 1925, pro parte. — Sasaki, Cat. Gov. Herb. 316. 1930. — Suzuki in Masamune Short Fl. Form. 125. 1936.

Ilex arisanensis Yamamoto Suppl. Ic. Pl. Form. 1: 30, fig. 10. 1925. — Sasaki, Cat. Gov. Herb. 316. 1930. — Kanehira, Form. Trees, rev. ed. 370. 1936. — Suzuki in Masamune, Short Fl. Form. 124. 1936.

Ilex warburgii sensu Yamamoto, Suppl. Ic. Pl. Form. 1: 40. 1925, non Loes., 1901.

Ilex buergeri Miq. var. *glabra* Loes. was based on *Faurie 39* from Taiwan. In the herbarium of the Arnold Arboretum there are two sheets of this number. Their glabrous stems, caudate leaves, and very short fruiting pedicels are characteristic of *Ilex ficoidea* Hemsl. In making this variety a synonym of *Ilex warburgii*, Yamamoto misinterpreted the latter species.

The type of *Ilex glomeratiflora* Hayata represents a staminate plant of *Ilex ficoidea* Hemsl., which has very short pedicels, 1.5 mm. long. Yamamoto wrongly identified the long pedicellate fruiting material of *Ilex uraiensis* Yamamoto as the female plant of *I. glomeratiflora*, and at the same time determined *U. Faurie 186* as *Ilex arisanensis*. This last taxon represents a plant with short fruiting pedicels. Both Sasaki's and Faurie's collections were from Arisan. They represent the staminate and pistillate plants of the same species, *Ilex ficoidea* Hemsl.

21. *Ilex liukuensis* Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 336 (Monog. Aquif. 1: 336). 1901. — Sasaki, Cat. Gov. Herb. 317. 1930. — Masamune & Suzuki in Ann. Rep. Taihoku Bot. Gard. 3: 61. 1933. — Sonohara et al., Fl. Okinawa 92. 1952.

Ilex mertensii sensu Ito & Matsum. in Jour. Coll. Sci. Univ. Tokyo 12: 369 (Tent. Flor. Lutch. 369). 1900. — sensu Sonohara et al., Fl. Okinawa 92. 1952, non Maxim., 1888.

Evergreen trees up to 8 m. high, entirely glabrous; branchlets of the third year's growth 3 mm. in diameter, rugose with large, slightly elevated leaf-scars and scars of the inflorescences, the lenticels lacking, the current year's growth 1.7 mm. in diameter, striate. Leaves occurring also on the third year's growth, 3–10 mm. apart, the stipules minute, often obsolete; petioles 10–16 mm. long, up to one third the length of the lamina, narrowly canaliculate above; lamina coriaceous, brunnescens, rarely olivaceo-brunneous, obovate, or oblong-elliptic, those near the apex sometimes elliptic, 3–7.5 cm. long, 1.8–3.5 cm. wide, acute at the base, obtuse, rounded, retuse or broadly short-acuminate at the apex, the margin recurved and obviously thickened, subentire or remotely crenulate, the midrib plane above, elevated beneath, the lateral nerves 5 or 6, obscure above, prominent and noticeably reticulate beneath. Staminate inflorescence unknown. Pistillate inflorescence fasciculate, 2–4-flowered, the pedicels 9–14 mm. long, each with two prophylls inserted 1–2 mm. above the base; calyx patelliform, 2 mm. across, 4- or 5-lobed, the lobes rounded, ciliate; corolla rotate, 8 mm. across, the petals more or less free, oblong, 3.5 mm. long, ciliate at the apex; staminodes half the length of the petals, the anthers sagittate, ovary ovoid, 1.5 mm. long, the stigma discoid. Fruit globose, 6 mm. in diameter, the persistent calyx explanate, the stigma navel-like, 4-lobed. Pyrenes 4, the back oblong in outline, 4.5 mm. long, 3 mm. wide, the middle longitudinally depressed, rugose and obliquely striate, the endocarp woody.

LIUKIU ISLANDS: Iriomotto [Iriomote], *Warburg* in 1887 (fragment of the TYPE, A); same island, between Shira-hama and Sonai, *E. H. Walker & S.*

Tawada 6528. Ishigaki Island, *E. H. Walker & S. Tawada* 727. Okinawa, Nago-Dake, *T. Kanashiro* 1697 (US), 1812.

I have also seen some sterile material from Yokohama Nursery.

The woody, rugose, dorsally impressed pyrenes, the relatively long-petiolate, obovate or oblong-elliptic leaves, the fasciculate fruit, and the absence of lenticels on the third year's growth of *Ilex liukiensis* all suggest a close relation with *I. graciliflora* Champ. of Hongkong. Besides the geographical separation, the latter species differs in having sparsely puberulous branchlets, pedicels 4–6 mm. long, and thickly coriaceous leaves.

In Liukiu the plant occurs on forest ridges. The fruit begins to turn red in middle August.

22. *Ilex uraiensis* Yamamoto in Jour. Soc. Trop. Agr. Taiwan 4: 486. 1932. — Suzuki in Masamune, Short Fl. Form. 126. 1936. — S. Y. Hu in Jour. Arnold Arb. 30: 382. 1949.

Ilex mutchagara sensu Sasaki, Cat. Gov. Herb. 318. 1930. — sensu Kanehira, Form. Trees, rev. ed. 378, fig. 335. 1936, non Makino, 1913.

Ilex uraiana Hayata in sched. ex Kanehira, l.c., in syn.

Ilex kelungensis sensu Kanehira & Hatusima in Trans. Nat. Hist. Soc. Form. 29: 156. 1939, non Loes. 1901.

TAIWAN: without precise locality, *W. R. Price* 262 (fragment).

Ilex uraiensis Yamamoto was based on material collected from Uraisha and Sozan of northern Taiwan, with the type from Sozan. This material was interpreted as *Ilex mutchagara* by Sasaki, as indicated by his citations, in 1930, and by Kanehira in 1936. As Kanehira was the Director of the Department of Forestry, Government Research Institute, and Sasaki the Curator of the Herbarium of the same department, it was natural for them to base their misinterpretation on the same material of *I. mutchagara* Makino. Sasaki cited no synonyms. Kanehira overlooked Yamamoto's publication and credited the binomial to Hayata as *Ilex uraiana* Hayata in sched. Both Kanehira and Sasaki were mistaken in maintaining that the Uraisha and the Sozan specimens were conspecific with the Liukiu *I. mutchagara* Makino. Kanehira's illustration, based on northern Taiwan material, was certainly not Makino's Liukiu species. In the Arnold Arboretum we have several collections with both flowering and fruiting specimens from Sozan, the type locality of *Ilex uraiensis* Yamamoto. *Wilson* 10288, a staminate plant in full bloom, matches Kanehira's figure in every respect. The leaves of this specimen appear similar in size and shape to those of *I. mutchagara* Makino. But the lower surface of Makino's species is "brownish-puncticulate" and that of the Sozan material is not. Moreover, the endocarp of the pyrenes of the Liukiu species is "smooth, thin, coriaceous," while that of the Sozan species is "irregularly striate, wrinkled . . . and stony." The punctate leaves, black fruits, and smooth coriaceous endocarps of *Ilex mutchagara* Makino place it in the section *Paltoria*, while the crenulate-serrate leaves, the fasciculate red fruits and the irregularly striate,

wrinkled and stony endocarps of *Ilex uraiensis* Yamamoto place it in the *Denticulatae* series of the section *Aquifolium*. The resemblance in size and shape of the leaves in these two species is very superficial.

Again, in 1939, Kanehira and Hatusima interpreted *Ilex uraiensis* Yamamoto as conspecific with *Ilex kelungensis* Loes. The latter species was based on Warburg's collection made in November 1895 at Kelung, a port in the northeastern part of Taihoku. Its elliptic-lanceolate leaves with obscure reticulate veinlets on the lower leaf-surface, and the small fruits on very short pedicels (2–3 mm. long), are characteristic of *Ilex formosana* Maxim., to which it belongs. *Ilex uraiensis* Yamamoto, on the other hand, is characterized by its prominently reticulated leaves and larger fruits on pedicels 6–8 mm. long. The size and shape of the smaller leaves of this species appear to resemble those of the isotype of *Ilex kelungensis* Loes., which I interpret to be conspecific with *I. formosana* Maxim. It was probably on account of this superficial resemblance that Kanehira and Hatusima made *I. uraiensis* Yamamoto a synonym of *I. kelungensis* Loes.

22a. *Ilex uraiensis* Yamamoto var. *formosae* (Loes.) S. Y. Hu in Jour. Arnold Arb. 30: 383. 1949.

This variety differs from the typical *Ilex uraiensis* Yamamoto in its smaller obovate leaves with rounded or obtuse apex.

22b. *Ilex uraiensis* Yamamoto var. *macrophylla* var. nov.

Frutex, ramulis glabris; foliis coriaceis, ellipticis, raro obovato-ellipticis, 7–10.5 cm. longis, 3.5 cm. latis, basi acutis, apice brevi-acuminatis, acumine 5–10 mm. longis; fructibus fasciculatis, pedicellis 6–8 mm. longis.

TAIWAN: Kiirun, T. Tanaka & Y. Shimada 17797 (TYPE).

This large-leaved variety differs from the typical *Ilex uraiensis* Yamamoto in which the elliptic or obovate-elliptic leaves measure only 3–7 cm. long and 1.5–2.5 cm. wide.

23. *Ilex warburgii* Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 326 (Monog. Aquifol. 1: 326). 1901.—Yamamoto, Suppl. Ic. Pl. Form. 1: 40. 1925.—Suzuki in Masamune, Short Fl. Form. 126. 1936.

A small evergreen tree up to 4 m. high; branchlets glabrous, the third year's growth 3–4.5 mm. in diameter, the lenticels obscure, the leaf-scars suborbicular, the current year's growth 1.5–2 mm. in diameter, subterete, the terminal buds conic, pubescent. Leaves 1–2 cm. apart, occurring also on the second year's growth, the stipules obscure, the petioles 8–15 mm. long, up to one fifth the length of the lamina, deeply canaliculate, minutely puberulent or glabrescent above; lamina coriaceous, olivaceous, oblong-elliptic, rarely broad elliptic, 4–8.5 cm. long, 2.4 cm. wide, obtuse or rounded at the base, abruptly caudate at the apex, the acumen 8–15 mm. long, 2–3 mm. wide, the width rather uniform, remotely crenulate-serrate, the midrib

impressed above, glabrous or very minutely puberulent, elevated beneath, the lateral nerves 7 to 9 pairs, obscure above, evident beneath, reticulate near the margin. Flowers not known. Infructescence fasciculate or subracemose, the central axis up to 6 mm. long, the pedicels of individual fruits 4–8 mm. long, the prophylla basal or medium, the fruit globose, 5–6 mm. in diameter, the persistent calyx explanate, 2 mm. across, the lobes ciliate, the stigma navel-like. Pyrenes 4, short and robust, rugose, striate and sulcate, the back ovate in outline, 4 mm. long, 3 mm. wide, the endocarp woody.

TAIWAN: Taihoku, Shirin, Taihoku Univ. Herb. no. 11132; Shirin to Sozan, *E. H. Wilson* 10298.

LIUKIU ISLANDS: Ischigaki (Ishigaki), *Warburg* (fragment of TYPE). Yaeyama Gunto, Iriomote, *E. H. Walker & S. Tawada* 6665.

This species is closely related to *Ilex ficoidea* Hemsl., which is characterized by its very short (2–3 mm. long) fruiting pedicels.

24. *Ilex pubescens* Hook. & Arn., Bot. Beechey Voy. 167, *pl.* 35. 1833. — Yamamoto, Suppl. Ic. Pl. Form. 1: 39. 1925. — Sasaki, Cat. Gov. Herb. 318. 1930. — S. Suzuki in Ann. Rep. Taihoku Bot. Gard. 1: 154. 1931, et in Masamune, Short Fl. Form. 125. 1936. — S. Y. Hu in Jour. Arnold Arb. 31: 220. 1950.

TAIWAN: between Goshyo & Suizya, *S. Suzuki* 5799; Taihokuzyu, Bunzangun, *Suzuki-Tokio* 8822; same locality, *S. Suzuki* on April 30, 1933. Baran, *Kudo-Sasaki* 15126.

This species was first published on the basis of material collected from Hongkong. It has a wide range of distribution on the mainland of China, from Chekiang and Anhwei southward to Kwangtung and Kwangsi. In Taiwan it has been reported from Sozan, Heirinbi, Taihei, and Urai in the northern part of the island, from Nanto and Lake Candidius in the central part of the island, and from Kosyun and South Cape at the southern extremity of the island. It is a common shrub in thickets along the roadside at altitudes 600–750 meters. Its pinkish flowers appear in late March and its scarlet fruit lasts on the bush all through the winter.

25. *Ilex cochinchinensis* (Lour.) Loes. in Nov. Act. Acad. Caes. Leop.-Carol. Nat. Cur. 78: 230 (Monog. Aquif. 1: 230). 1901. — S. Y. Hu in Jour. Arnold Arb. 31: 239. 1950.

Ilex ardisioides Loes. op. cit. 359. 1901. — Sasaki, Cat. Gov. Herb. 316. 1930. — Suzuki in Masamune, Short Fl. Form. 124. 1936.

In Taiwan this species occurs only at the southern extremity of the island. It is found also in Hainan and northern Indo-China. Its large entire punctate leaves and its fasciculate fruits are very characteristic. In commenting on *Ilex ardisioides* Loes., Hayata wrote in 1911, "a species imperfectly known to me." Two years later he published *Ilex cleyeroides*, which is a synonym of *Ilex cochinchinensis* (Lour.) Loes.

26. *Ilex goshiensis* Hayata in Jour. Coll. Sci. Univ. Tokyo 30: 54 (Mat. Fl. Form. 54). 1911, et Ic. Pl. Form. 1: 131. 1911. — S. Y. Hu in Jour. Arnold Arb. 31: 248. 1950.

Ilex hanceana sensu Ito & Matsum. in Jour. Coll. Sci. Univ. Tokyo 12: 367 (Tent. Fl. Lutch. 367). 1900. — sensu Hayata, Ic. Pl. Form. 6 (Suppl.): 13 (Gen. Ind. Fl. Form. 13). 1917. — sensu Sasaki, Cat. Gov. Herb. 317. 1930. — sensu Sonohara et al., Fl. Okinawa 92. 1952, non Maxim., 1881.

LIUKIU ISLANDS: Okinawa, *T. Miyagi* (fragment); Kunigami, Tanyu-dak, *S. Sonohara*, *S. Tawada* & *T. Amamo* 6308; Genka Mt., *E. H. Wilson* 8091 (A, US).

JAPAN: Kyushu: Hingo, Koonose, *K. Mayebara* 320 (fragment); Mt. Kirshima, *Z. Tashiro*, May 8, 1913 (sterile).

This species has been misinterpreted as *Ilex hanceana* Maxim. by many botanists. Through Dr. H. Hara of the Botanical Institute, University of Tokyo, I have obtained fragments of the type material for comparison, accompanied by an excellent photograph. The elongated pedicels, the fasciculate umbelliform inflorescences, with the individual branches 3- to 7-flowered, and the globose fruit with slightly elevated discoid stigmata, are distinct features of this species. It is very different from *Ilex hanceana* Maxim., which has paired fruits on very short (1.5 mm. long) pedicels.

In Taiwan and Liukiu this species appears to be a small tree up to 6 meters high. It is common at altitudes of 100–600 meters. Its fruit turns red in August (fide Gressitt) and remains dull red until March (fide Wilson).

27. *Ilex hayataiana* Loes. in Fedde Rep. Spec. Nov. 55: 333. 1941. — S. Y. Hu in Jour. Arnold Arb. 31: 249. 1950.

LIUKIU ISLANDS: Okinawa: Yona, *J. W. Conover* 1139, 1840 (US); Kunigami, Nago-dake, *E. H. Walker*, *S. Sonohara*, *S. T. Tawada* & *T. Amano* 6192. Irumuti (Iriomote), *S. Murayama* in 1927.

This species differs from *Ilex goshiensis* Hayata in having narrower leaves with acuminate or caudate apex and fasciculate uniflorous individual branches in the inflorescences. It has been reported to be abundant at altitudes of 230–330 meters, where it grows as a small tree along the banks of streams in the shade of taller trees or steep walls of the valleys.

DOUBTFUL AND EXCLUDED SPECIES

Ilex cinerea sensu Ito & Matsumura in Jour. Coll. Sci. Univ. Tokyo 12: 369 (Tent. Fl. Lutch. 369). 1900. — Sonohara et al., Fl. Okin. 92. 1952, non Champ., 1852.

Ilex cinerea Champ. ex Benth. is endemic to Hongkong. Its large oblanceolate leaves with very short (2–4 mm. long) petioles and its very short (2–3 mm. long) pedicellate fruits are very characteristic. Many East Asian specimens belonging to *Ilex ficoidea* Hemsl. or *I. formosana* Maxim.

have been erroneously named *Ilex cinerea* Champ. It is quite likely that authors dealing with the flora of the Liukius may have made similar errors, since I have no evidence, from the material which I have examined, to lead me to believe that the species has ever been collected outside Hongkong.

ILEX MATANOANA sensu Sasaki, Cat. Gov. Herb. 317. 1930. — sensu Masamune & Suzuki in Ann. Rep. Taih. Bot. Gard. 3: 61. 1933, non Makino, 1913.

Ilex matanoana Makino was first published from the Bonin Islands. Its small coriaceous obovate leaves with retuse apex and prominently reticulate nerves are very characteristic. Judging from the material I have studied, the species of *Ilex* in the Bonin Islands are very different from those of Taiwan and the Liukiu Islands. In fact, there is no Bonin Island element of *Ilex* found in the flora of Taiwan and Liukiu. Sasaki ascribed specimens collected from Sozan, Giran, and Kosyun to this species. Masamune & Suzuki recorded it as occurring on Kizan, a small volcanic island northeast of Taiwan. They cited no specimens. As these collections are not available for my examination, I can only question their interpretation.

Ilex nokoensis Hayata in Jour. Coll. Sci. Univ. Tokyo 30: 56 (Mat. Fl. Form. 56). 1911, et in Ic. Pl. Form. 1: 133. 1911. — Kanehira, Form. Trees, 1st ed. 125. 1917 = *Symplocos nokoensis* (Hayata) Kanehira, Anat. Charact. Ident. Form. Woods 151. 1921, et Form. Trees, rev. ed. 596, fig. 553. 1936.

ILEX EURYAEFOLIA Mori & Yamamoto in Jour. Soc. Trop. Agr. Form. 4: 485. 1932.

This species was based on *T. Suzuki* 7332, collected from Mt. Taihei in the northeastern part of Taiwan. According to the description of the authors, the plant has "Folia coriacea . . . longe elliptica vel oblongo-oblan-
ceolata vel subspathulata . . . apice [obtusa], . . . margine ad totam
crenato-serrata sed raro inferne integra . . . petiolis brevibus 3–5 mm.
longis . . . Inflorescentia fructifera axillaris, umbellaeforme fasciculata
. . . Fructus globosi, 4 mm. in diametro, apice stigmate rostrati . . .
pyrenis 4."

ILEX RARASANENSIS Sasaki in Trans. Nat. Hist. Soc. Form. 21: 154. 1931.

This species was based on Sasaki's own collection from Mr. Rarasan of Taihoku prefecture. According to his description the plant has "Leaves
sempervirens, alternate and fascicles near the top of the branches . . .
elliptic or ovate, entire or loose serrate . . . acuminate or caudate . . .
Inflorescens [sic] umbellate panicles, terminal axillis [sic] of the branches,
peduncles umbell [sic] . . . Drupe . . . 6 mm. in diameter, shining
chestnut colour when ripe. Seed [sic] 6 . . . 3–4 mm. long, 2 mm. in
diameter."

Kanehira in 1936, without giving any reason, excluded *I. varasanensis* Sasaki and *I. euryaeifolia* Mori & Yamamoto from the Aquifoliaceae in his Formosan Trees. In order to ascertain the status of these taxa, I wrote to Professor W. F. Chu, Head of the Department of Forestry, National Taiwan University, asking him for the photographs and fragments of the type material of these species. He very kindly searched in the Herbarium of the Department of Botany of the same University and also in the Government Herbarium of the Department of Forestry, Government Research Institute, of which Sasaki was curator. Unfortunately no traces of these species could be found. For the present they have to be classified among the doubtful species.

ARNOLD ARBORETUM,
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A TAXONOMIC REVISION OF *PODOCARPUS*
VIII. THE AFRICAN SPECIES OF SECTION *EUPODOCARPUS*,
SUBSECTIONS A AND E

NETTA E. GRAY *

THE SECTION *Eupodocarpus* of the genus *Podocarpus* is well represented on African mountain slopes from the southernmost coast to well north of the equator in both the eastern and western regions, wherever relatively cool and wet climates are found. In many regions the species are found in pure stands, often of magnificent timber which has been very important economically. In other parts the members are less abundant, interspersed among other trees, but still constituting an item in the lumber industry. The five species on the continent (all in subsection A) are *Podocarpus elongatus* (Ait.) L'Hérit., *P. Henkelii* Stapf, *P. latifolius* (Thunb.) R. Br. and *P. milanjanus* Rendle, which have been compared by Stapf (10) and Chalk et al. (3), and *P. ulugurensis* Pilger, which was subsequently described (7). *Podocarpus madagascariensis* Baker, endemic on the island of Madagascar, is also in subsection A and has been treated separately by Laurent (4). *Podocarpus rostratus* Laurent, also confined to the island of Madagascar, is in the new subsection E. Our studies show that *P. rostratus* has close affinities with section *Eupodocarpus*, but we recommend placing it in a separate monospecific subsection. Details leading to this decision are to be found under the discussion of the species.

The leaf anatomy of the group consisting of *P. elongatus*, *P. latifolius*, *P. Henkelii*, *P. milanjanus* and *P. madagascariensis* is quite similar, displaying only very minor variations. It always shows two marginal resin canals, hypoderm between the stomatal rows on the lower side, the Florin ring in the stomatal subsidiary cells, and toothed or pitted walls in the epidermal cells.

In addition, we find that *P. elongatus* can usually be distinguished from the others of the group by the thicker palisade parenchyma of more than one layer and no auxiliary sclereids in the mesophyll. In most specimens there is only one vascular resin canal. In most leaves the upper hypoderm is occasionally interrupted and it has been found that these interruptions

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are accompanied by one to six short rows of stomata in the upper epidermis. Thus, *P. elongatus* is differentially amphistomatic, a unique character in the section *Eupodocarpus*. Vascular sclereids or fibers in *P. elongatus* are rare, and the stomatal rows seem closer together than in *P. latifolius* and *P. Henkelii*. Hypodermal fibers average 12–18 μ in diameter, somewhat smaller than those in the other species.

In some specimens of *P. latifolius* and *P. Henkelii* the leaf characters seem to overlap those of *P. elongatus*, but there are generally three vascular resin canals, continuous upper hypoderm, larger hypodermal fibers (15–23 μ average diameter), stomatal rows somewhat farther apart, palisade parenchyma only one cell-layer thick, auxiliary sclereids in the mesophyll, and no stomata on the upper side.

Podocarpus milanjanus, usually having the margins of the leaves revolute, often has the upper hypoderm interrupted at the point of the turn. There is often much increased sclerification, this appearing in auxiliary sclereids in the mesophyll, heavier walls in the accessory transfusion tissue and more abundant upper and lower vascular fibers. *Podocarpus madagascariensis*, however, shows the most extreme sclerification, affecting most of the mesophyll.

The specimen of *P. ulugurensis* which we examined shows the striking difference of five instead of three vascular resin canals. The two extra ones appear in or very close to the transfusion tissue. Externally, this is the only species with a definitely sulcate upper midvein.

KEY TO SECT. EUPODOCARPUS (AFRICAN SPECIES), SUBSECTIONS A AND E

- Leaves very small; many marginal resin canals, accessory transfusion tissue absent Subsection E. *P. rostratus*.
- Leaves larger; 2 marginal resin canals, accessory transfusion tissue present.
 - Leaves with 5 vascular resin canals; upper midrib sulcate. . . *P. ulugurensis*.
 - Leaves with 1–3 vascular resin canals; upper midrib never sulcate.
 - Leaves narrowly lanceolate, 3.5–6.5 cm. long, 3.5–4 mm. wide, acute to obtuse at tip. *P. elongatus*.
 - Leaves elongate and broader.
 - Adult leaves very large, 7–18 cm. long.
 - Male cone very short, 13 mm. long.
 - Leaves 8–18 cm. long, 8–18 mm. wide; seed 20 mm. long. *P. madagascariensis*.
 - Leaves smaller, 5–7 cm. long, 6 mm. wide; seed 28 mm. long. *P. madagascariensis* var. *rotundus*.
 - Male cone longer, 20–45 mm. *P. Henkelii*.
 - Adult leaves smaller, juvenile often as large as above.
 - Leaves gradually attenuate. *P. milanjanus*.
 - Leaves short rotundate, angustate at tip.
 - Leaves 5–11 mm. wide. *P. latifolius*.
 - Leaves 12–17 mm. wide. *P. latifolius* var. *laticor.*

Podocarpus elongatus (Ait.) L'Hérit. in Pers. Syn. 2: 580. 1807; L. C. & A. Richard, Comm. Bot. Conif. 13. 1826; Endlicher, Syn. Conif. 218. 1847; Carrière, Traité Conif. ed. 2, 671. 1867, in part; Parlato

in DC. Prodr. 16 (2): 511. 1868; Van Tieghem in Bull. Soc. Bot. France 38: 169. 1891; Pilger in Pflanzenreich IV. 5 (Heft 18): 89. 1903, in Nat. Pflanzenfam. ed. 2, 13: 247. 1926; Dallimore & Jackson, Handb. Conif. 44. 1923, 1931, 66. 1948; Florin in Svenska Vet.-Akad. Handl. ser. 3, 10: 279. 1931; Chalk, Burt-Davy & Desch, For. Trees & Timbers Brit. Emp. 1: 24. 1932; Stapf in Fl. Cap. 5 (Sect. 2, suppl.): 8. 1933.

Podocarpus Thunbergii var. *angustifolia* Sim fide Dallimore & Jackson, Handb. Conif. 44. 1923, 1931.

Taxus elongata Aiton, Hort. Kew. 3: 415. 1789; Thunberg, Prodr. Fl. Cap. 117. 1800.

Taxus capensis Lamarck in Encycl. 3: 229. 1789.

Podocarpus elongatus is found on the Cape of Good Hope on Table Mountain above the city of Capetown, and hence was one of the plants early brought from that region. Pilger (6) distinguished it from *P. latifolius* and *P. milanjanus* by its narrow lanceolate-linear leaves. Stapf (10) separated it from *P. Henkelii* by its short straight leaves and fleshy receptacle and from *P. latifolius* by leaves only up to 4 mm. wide. Chalk (3), on the other hand, distinguished it from *P. Henkelii* and *P. latifolius* by its red receptacle (which seems to be in error) and from *P. milanjanus* by leaves shorter and much narrower (2.5–5 cm. \times 2–3 mm.). Of the species studied by Laurent (4), *P. elongatus* has the shortest, narrowest leaves, shorter male cones than those of *P. latifolius* and *P. milanjanus*, the shortest peduncle on the female cone, and the smallest seed. According to the descriptions, the twigs of *P. elongatus* are drooping while those of *P. latifolius* are erect with leaves stiff. We would distinguish it from *P. latifolius* by the consistent absence of auxiliary sclereids, the one vascular resin canal (rarely 3), the interrupted upper hypoderm, and the 1–6 upper rows of stomata. The thick leaves show no tendency to be revolute.

The differences from *P. latifolius* seem to be chiefly relative. Many of the sterile specimens referred to *P. elongatus* which show wider leaves and no stomata in the upper epidermis belong probably to *P. latifolius*, which has considerable range in leaf size and also a much wider geographical distribution. Both these species may be found in the same area, often being collected by an explorer on the same day. Their close similarity and the existence of a number of specimens intermediate between the two definitely suggest hybridization. *Podocarpus elongatus* seems to be chiefly a plant of western Cape Province.

MacOwan 1958, in both the Gray and Kew Herbaria, has two elements on it, the portion with larger leaves being *P. latifolius* and that with small leaves being *P. elongatus*. This latter has both a single vascular resin canal and a few stomata on the upper surface.

In all cases it must be borne in mind that for more than fifty years *P. elongatus* (Ait.) L'Hérit. and *P. falcatus* R. Br. (in section *Afrocarpus*) were almost hopelessly confused in the literature, and the identity of the

actual material discussed must be checked with greatest care. *Podocarpus elongatus* is the only species in the section *Eupodocarpus* with scattered stomata occurring on the upper side of the leaf. This may have been noted by some earlier workers, giving credence to the incorrect determination *P. falcatus*, a species with leaves always equally amphistomatic.

Since *Podocarpus elongatus* (Ait.) L'Hérit. was used by Persoon as the type species for the genus, a most diligent search was made for the type specimen. An original Thunberg specimen of this species is in the Botanical Museum at Uppsala with other plants he collected in and near Capetown in 1773–1774. It is a male specimen with almost mature pollen cones. A female specimen, with immature ovules, was found in the Paris Museum, collected by Sonnerat (Herb. Jussieu 17135) in 1774 in the company of Thunberg on the occasion of his visit to Capetown and ascent of Table Mountain, the site of the former collection. This specimen was probably collected at a later season than the Thunberg specimen. Confusion arose when it was found that a specimen in the British Museum, indicated as the probable type for Aiton's *Taxus elongatus* in his *Hortus Kewensis*, was really *P. macrophyllus* var. *Maki* from Japan. This mistaken identity is reasonable as the male specimens of the two entities are very similar to the naked eye although the leaves of *P. elongatus* are usually narrower. In this case, the leaf anatomy carries the proof of identity. No doubt there are other good specimens in the British Museum that we have not seen, as Stapf (10) mentions one by Masson who accompanied Thunberg in his original travels. Nor have we seen the specimen used by L. C. Richard for his drawing of *P. elongatus* with seeds, in the publication of 1826 (9).

We feel that the designation of the *Thunberg* (male) specimen at Uppsala Botanical Museum and the *Sonnerat* (female) specimen at the Paris Museum as lectotypes will make this species better understood by later investigators. In genera composed of dioecious species it is desirable to designate both male and female specimens. It is to be hoped that the misidentified specimen will be removed from a type-folder.

DISTRIBUTION: South Africa, in forested areas in southwestern Cape Province primarily.

SPECIMENS EXAMINED:

SOUTH AFRICA: Cape Province: Clanwilliam Division: Grarsangen Mt., *Pillans* 8676 (K); * Oliphant's River, Kradouw Krantz, *Pillans*

* The following symbols indicate the herbaria having the specimens cited: Academy of Natural Sciences of Philadelphia (Ph), Arnold Arboretum (A), British Museum (BM), Brussels Botanical Garden (BR), University of California at Berkeley (UC) and at Los Angeles (LA), California Academy of Science (CAS), Chicago Natural History Museum (Field Museum) (F), Cornell University (CU), Gray Herbarium (GH), University of Illinois Herbarium (Ill), Royal Botanic Gardens, Kew (K), Missouri Botanical Garden (Mo), New York Botanical Garden (NY), Rutgers University Herbarium (NJU), Stanford University Dudley Herbarium (DS), United States National Herbarium (US), Uppsala Botanical Museum (UPS), Yale University Herbarium (YU).

5297 (K), *Pearson 5328* (†K), *Wilson* in 1922 (A—4 sheets); Krakadow Pass, Cedarburg Mts., *Wilson* in 1922 (†A); Ceres, *Munchen 11764* (†NY), *Pearson 15551* (†LA). Malmesbury: Paarl Berg, *Prior* in 1946 (K), *Drege 1839* (K); Stellenbosch, *Miller s.n.* (K), *Garside 1044* (†K); Robertson, Banks of Breede River, *For. Dept. Pretoria Herb. 1247* (K), *Wilson* in 1923 (†A—5 sheets). Swellendam Division: Breede River, *Burchell 7480* (K), *Schlechter 5652* (K); Table Mtn. *Thunberg s.n.* (†UPS), *Sonnerat ex Herb. Jussieu 17135* (†P). Albany Division: w. of Grahamstown, *Zeyher 3448* (K), *MacOwan 1958*, in part (†GH, †K); Olijantshoek, *Zeyher s.n.* (†A); Steudel, Eptingee, *Ecklon* in 1834 (†NY); Bain's Kloof, *Hutchinson 1008* (†K); Kaffraria, Dohne, *Sim 19620* (†A). LOCALITY NOT INDICATED: ex Hook. Herb., *Pappe s.n.* (K), *Anon.* in 1906 (A), "Hort. Daudin" in 1851 (†DS), *Prager s.n.* (†CAS), *Ecklon & Zeyher s.n.* (†Mo), *Marloth 11488* (†A), "EM" 81 (†Mo).

CULTIVATED: Algeria For. Sta., *Wilson* in 1922 (A), Piquetberg, Bosch Kloof, *Compton 9498* (†Ill). U.S., Mass., Arnold Arboretum 482.29, *Judd* in 1930 (A).

Podocarpus latifolius (Thunb.) R. Br. ex Mirb. in Mém. Mus. Nat. Hist. Paris 13: 75. 1825; Berthold, Vergleichenden Anatomie der Coniferen-Blättern 12, 16. 1875; Zimmerman in Flora 63: 2. 1880; Pilger in Pflanzenreich IV. 5 (Heft 18): 90. 1903; in Nat. Pflanzenfam., ed. 2, 13: 247. 1926; Florin in Svenska Vet.-Akad. Handl. ser. 3, 10: 279. 1931; Stapf in Fl. Cap. 5 (Sect. 2, suppl.): 5. 1933; Dallimore & Jackson, Handb. Conif. 48. 1923, 1931, 72. 1948; Chalk, Burt-Davy & Desch, For. Trees & Timbers Brit. Emp. 1: 23. 1932; Chalk et al., For. Trees & Timbers Brit. Emp. 3: 81. 1935; Adamson in Fl. Cap. Penin. 31. 1950.

Podocarpus Thunbergii Hook. in London Jour. Bot. 1: 657. 1842; Endlicher, Syn. Conif. 217. 1847; Carrière, Traité Conif. ed. 2, 710. 1867; Mahlert in Bot. Centralbl. 24: 281. 1885; Parlatore in DC. Prodr. 16 (2): 511. 1868.

Podocarpus Thunbergii var. *latifolia* Sim fide Dallimore & Jackson, Handb. Conif. 48. 1923, 1931; Van Tieghem in Bull. Soc. Bot. France 38: 169. 1891.

Podocarpus Sweetii C. Presl in Bot. Bemerk. 110. 1844.

Nageia latifolia O. Kuntze in Rev. Gen. 2: 800. 1891 (not Gordon).

Taxus latifolia Thunb. Prodr. Fl. Cap. 117. 1794–1800 et Fl. Cap. (ed. Schultes) 547. 1823.

This species is very large, often found very abundantly in the south-eastern part of Cape Province, and important economically as a lumber tree. Its foliage differs from *P. Henkelii* in the shorter and smaller rigid leaves on erect twigs and fleshy receptacle, and from *P. elongatus* by the wider leaves with three vascular resin canals and no stomata on the upper side.

Podocarpus latifolius shows wide variation in its foliage as would be expected in a species of such wide distribution. It seems to be midway between *P. elongatus* and *P. milanjanus*, with many sterile specimens diffi-

† This symbol preceding the abbreviated name of an herbarium following the specimens examined signifies that the details of the leaves of this specimen have been examined in cross-section.

cult to classify because of extreme characters. The difference between juvenile and adult foliage, which has already been noted in a number of species, adds to the range of characters involved. A detailed description may be found in Chalk (3) and Stapf (10).

Of the varieties of this species which have been described, Stapf (10) and Chalk (3) disposed of most. However, the variety *P. latifolius* var. *latifolia* still standing deserves comment. With its long narrow leaves it seems that this should be a variety of *P. elongatus*, while the erect leaves around rigid twigs show a relation to *P. latifolius*. However, the leaves "1-2 in. long \times 2-3 lin. wide" are long narrow leaves and certainly belie Chalk's and Stapf's suggestion that it is the common form in the Cape Colony with its "short, wide leaves." Robyns (8) says that the green color of the receptacle, which has been given by certain authors as a distinctive character for *P. latifolius*, should not receive consideration. Stapf (10) indicates that, in a mature state, this receptacle is vividly colored red as in *P. milanjanus* and he describes it as resembling a "small dark red cherry in color and shape." It is hard to understand why Chalk (3), after using and quoting Stapf, used a green receptacle for a key character only a year later.

DISTRIBUTION: Limited at present to South Africa, most abundant in the southeastern part, probably ranging farther north but no collections seen.

SPECIMENS EXAMINED:

SOUTH AFRICA: Transvaal: Zautpansberg, *Hutchinson & Gillett* 4283 (K—2 sheets), *Houseman* 5249 (K), *Obermeyer* 1228 (†F); Pietersburg, Houtboschberg, *Burt-Davy* 1194 (K); The Downs, Sabie, *Rogers* 21910 (K); Helpmakaar Arboretum, *Burt-Davy* 20252 (†A, †BR), *Leeman* 105 (†K); Blaauwburg, *Smuts* 906 (K); Waterberg, *I. B. Pole Evans* in 1933 (K); Nylstroom, *Burt-Davy* 4549 (†K), *Galpin* 11663 (†K). Swaziland: Forbes Reef Bush, *Burt-Davy* 2748; Kaaphe Kloof, *Rogers* 21089 (K), *Burt-Davy* 2455 (K). Orange Free State: Drakensburg, *Cooper* 1111 (†BM, K, NY). Natal: Zululand, Ngoya Forest, For. Dept. 4266, *Chilvers* (†A), *Wilson* in 1922 (A—2 sheets); Nat'l Park, Drakensburg, *Godman* 263 (†BM), *Hutchinson* 4488 (K); Champaign Castle, *Meebold* 13140 (NY); Durban, near garden, *Wilson* in 1922 (A), *Hout* in 1859 (K); Donneybrook, *Wilson* in 1922 (A); The Boyle, *Bews* in 1922 (A), *Wilson* in 1922 (A—2 sheets); Van Reeney Prop., *Kuntze* 1800 (K), *Gerard* 127 (K), *Sanderson s.n.* (†K). Cape Province: East Griqualand: Umzimkulu, Mhlonga Forest, For. Dept. Herb. Pret. 2168, 2170, 2189 (♀ & ♂) *Kaufmann* (K); Maclear Dist., Pot River Berg, *Galpin* 6831 (K); Emkazene Forest, Ingwangwane, For. Dept. Herb. Pret. 1957, *Houshold* (K); Instubani Forest, For. Dept. Herb. Pret. 2227, *Frazer* (K); Buswayo Forest, Manina, For. Dept. Herb. Pret. 2266, *Merwe* (K). Albany Division: near Grahams-town, *MacOwan* 1408 (F, K, YU), *MacOwan* 1958 in part (†GH, †K), *Wilson* in 1922 (A—2 sheets); w. of Grahamstown, *Zeyher* 3885 (K); Atherston, *Anon.* 89 (†K). Uitenhage Division: *Zeyher* 3880 (K). Knysna Dist.: Katzees Kraal, *Burchell* 5223, 5254 (†GH, K); Deepwalls Crown Forest, *Wilson* in 1922 (†A—2 sheets); Harberville Forest, *Keet* 524 (†K), *Bowie s.n.* (†K), *Burchell* 5223 (†K), *Wilson* in 1922 (A—2 sheets), *Munde & Maire* 1840 (K). George & Knysna: *Bowie s.n.* (K). George Dist.: *Drege* 1639 (K),

Burchell 5843 (†GH, K), *Burchell* 3505, 5843 (K). Cape Dist.: Table Mtn., near Brown's Krall, *Prior* in 1847 (K), *Wilson* in 1922 (†A—6 sheets), *Geehout* 12 (A), 223 (A), *Zeyher* 3533 (A); Stellenbosch, *Harvey s.n.* (†BM); Murchison, *Wood* 3028 (K); Newland woods, *Wolley Dod* 2729 (K); Groot Vader's Bosch, *Anon.* in 1906 (A), *Thunberg s.n.* (†UPS); Orange Kloof, *Gamble* 22002 (K); Oliphant's River, *Pillans* 5297 (†K); *Zeyher* 3882 (†K), 3883 (†K), *Munde & Maire s.n.* (†K). Cape Colony but no locality: *Anon.* in 1879 (CAS), *Drege s.n.* (†Mo), *Ecklon & Zeyher s.n.* (†A), *Burt-Davy* 4549 (†K), *Corney Westliche*, *Prager* 90 (†CAS), *Anon. s.n.* (K). No locality indicated: *H.R.P.* ex Herb. A.C.Limingani Comitatus A (DS), *Anon. s.n.* (K).

CULTIVATED: South Africa: Tokai, near Capetown, *G.A.W.* in 1912 (K), *Eames* in 1939 (CU); Cleremont Garden, The Hill, *Wilson* in 1922 (A—5 sheets); Mission de Bunia, *Gilbert* 505 bis (†BR); Newlands, Kirstenbosch, *Compton* in 1941 (†Ill). England: Kew, *Cook* in 1937 (†Ill), *Buchholz* in 1950 (†Ill).

Podocarpus latifolius* var. *latior Pilger in *Pflanzenreich* IV. 5 (Heft 18): 90. 1903; Stapf in *Fl. Cap.* 5 (Sect. 2, suppl.): 7. 1933; Chalk et al., *For. Trees & Timbers Brit. Emp.* 3: 82. 1935.

A variety with very wide leaves, which is easily recognizable.

DISTRIBUTION: Cape Province on mountain slopes, apparently quite rare.

SPECIMENS EXAMINED:

SOUTH AFRICA: Cape Province: Vogelgat, *Schlechter* 9542 (K, †Ph); Table Mt., *Wilson* in 1922 (†A), *Drege*, in part, ex *Bernhardi* Herb. (†Mo).

Podocarpus Henkelii Stapf ex Dallimore & Jackson, *Handb. Conif.* 47. 1923, 1931, 71. 1948; Florin in *Svenska Vet.-Akad. Handl.* ser. 3, 10: 279. 1931; Chalk et al., *For. Trees & Timbers Brit. Emp.* 1: 23. 1932, 3: 84. 1935; Stapf in *Fl. Cap.* 5 (Sect. 2, suppl.): 9. 1933.

This tree is closely associated with *P. latifolius*, but can readily be distinguished by the larger, drooping, attenuate and often falcate leaves. Its description, distribution and regeneration is treated at length by Chalk et al (3). In certain areas it is found abundantly (Natal, East Griqualand) where it forms 90% of the trees in pure open forests. In leaf anatomy it shows a range of variation similar to that of *P. latifolius*, and juvenile specimens of *P. latifolius* are often difficult to distinguish from it.

DISTRIBUTION: South Africa, in Natal, Swaziland, northern Transvaal and East Griqualand.

SPECIMENS EXAMINED:

SOUTH AFRICA: Transvaal: *Barborton* 2467 (†K). Natal: Swaziland, Forbes Reef, *Burt-Davy* 2748a (†K), Pretoria For. Dept. 1880, *Houshold* (K); Swartzkop, *Sim* in 1921 (A—3 sheets); *Donnybrook*, *Wilson* on Feb. 16, 1922 (A—7 sheets); Kirstenbosch, *Sim* 1252/14 (†Ill); Pietermaritzburg, *Lindeberg* in 1936 (†A), *Wilson* on Feb. 12, 1922 (A), *Wilson* on Feb. 14, 1922 (A—3 sheets ♂, 3 sheets ♀). Griqualand East: Mt. Ayliff, Ft. Donald,

Balembu Forest, *Cochrane* in 1920 (†K—2 sheets); Nguhi Forest, *Cochrane* in 1920 (K); Gsewaleni Forest, Pret. For. Herb. 2172, *Cochrane* (K); Insikini riverside, *Dawson* 1441 (†K). Cape Province: Knysna, *W. A. & C. B. Setchell* in 1927 (†UC). Locality unknown: *Ad No. 1282*, Ser. I, ex Herb. L. van den Bossche (†BR).

CULTIVATED: Africa: Tokai near Capetown, *Wilmot* in 1912 (K). England: Kew, *Buchholz* in 1950 (†III). United States: New York Bot. Garden in 1926 (†NJU).

Podocarpus milanjanus Rendle in Trans. Linn. Soc. ser. 2, 4: 61. 1844; Pilger in Pflanzenreich IV. 5 (Heft 18): 92. 1903, in Nat. Pflanzenfam. ed. 2, 13: 247. 1926; Dallimore & Jackson, Handb. Conif. 50. 1923, 1931, 75, 1948; Battiscombe, Desc. Cat. of Common Trees and Woody Plants of Kenya Colony 1. 1926; Florin in Svenska Vet.-Akad. Handl. ser. 3, 10: 279. 1931; Chalk, Burt-Davy & Desch, For. Trees & Timbers in Brit. Emp. 1: 24. 1932; Robyns in Inst. Roy. Col. Belge, Bull., 6: 226. 1935, in Fl. du Congo Belge du Ruanda-Urundi 1: 6. 1948; Chevalier in Rev. Bot. Appl. 19: 411. 1939.

Podocarpus milanjanus has a very wide tropical distribution from 15° s. lat to 10° n. lat. and across the entire width of the continent. It has wider leaves than *P. elongatus*, but no anatomical differences in the leaves from those of *P. latifolius* and *P. Henkelii*. However, the natural areas of these species are so far removed from each other that there is little chance of confusion. *Podocarpus milanjanus* shows considerable variation in the foliage due to its appearance in all horizons of mountain forest, even into subalpine regions where the reduction in size of both the foliage and the tree is considerable. In general appearance, the leaves seem to be more spreading than those of *P. latifolius*, but the form of the young specimens is very similar. The leaf anatomy shows no consistent difference of specific importance other than that the rows of stomata seem closer together.

In comparisons made by Laurent (4), *P. milanjanus* exceeds *P. latifolius* and *P. elongatus* in the greatest dimensions of leaves, male cones, peduncles, and length of seed. Chalk et al. (2) include it in their key to African *Podocarpus*, distinguishing it from *P. elongatus* by the larger leaves, but from *P. latifolius* only by the red receptacle which has been mentioned before as an error.

In a recent study of specimens accumulated at the Brussels Herbarium, Robyns (8) found such extreme variation that at first he thought he had more than one species, but his detailed discussion gives adequate evidence that this is within the range of normal variation of the species. Moreover, there is extreme difference between adult and juvenile foliage. Hence, Robyns abandons Pilger's *forma arborescens* and *forma typica*, and substitutes the more descriptive *forme adulte*, *forme éricoïde*, and *forme juvénile*. He illustrates these by photographs of both foliage and mature tree habit in the case of *forme éricoïde*.

DISTRIBUTION: Africa, from Cameroons and southern Sudan, south through Belgian Congo, Uganda, Kenya, Tanganyika, into Nyasaland and

southern Rhodesia, on mountain slopes and alpine zones from 1900–3500 m. altitude.

SPECIMENS EXAMINED:

SUDAN: Immatong Mts., Ras Logoforsk, *Chipp* 104 (†K); Mt. Kivetti, *Chipp* 85 (K); Lomwaga Mt., E. Acholi, *Greenway & Hummel* 7281 (K), *T. Smith s.n.* (K—2 sheets). UGANDA: Immatong Mts., *Eggeling* 3600, 3564 (K); Kigezi, *Eggeling* 3245, 3247, 3249, 3251 (K); Mt. Elgon, *Snowden* 438 (A, K); Bulanbuli, *Snowden* 912 (†A—3 sheets, BR, K—2 sheets); Butandiga, *Snowden* 964 (A, K); Benet, *Eggeling* 2465 (BR, K), *Eggeling* 2470 (K); *Dummer* 3623 (K), *Lugard* 694 (K); Entebbe, *Dawe* 273 (K); S. Budde, *Dawe* 969 (K); Benet Sabei Bugishu, *Thomas* 2633 (K). BELGIAN CONGO: Ruwenzori: Nyam-bitaba, *Humphreys* 1402 (†BM); s. of Butahu River, Bambune, *Chapin* 83 (†NY); westside, *Chapin* 113 (BR, †NY), *Bequaert* 3703 (BR), *Humbert* 8903 (BR); Lukubuku valley, *Eggeling* 1259 (K); *Fishlock & Hancock* 160 (†K), *Dawe* 547 (K), *Scott-Elliott s.n.* (K), *Doggett s.n.* (K), *Lebrun* 4570 (BR, K), *Purseglove* 347 (K), *Esmans* 15 (BR); Tschiaberimu massif, between Kasindi & Lubango, *Lebrun* 4762 (†BR, K); Mt. Tsiaberimu, *Prince Leopold* 49, 50, 51 (†BR); Kahuzi Massif, *Humbert* 7716, 7716bis, 7716ter (†BR), *Scaetta* 1408 (†BR, K); Mt. Kahuzi, *Scaetta* in 1928 (†BR), *Lebrun* 5528 (K); Virunga Mts., Mushubangabo Volc. *Burt* 3158 (K); s. slope, Chambragongo Saddle, *Burt* 3169 (BR, K); Nyirangongo Volc., *Humbert* 7951 (BR); Nyamlagira Volc., *Humbert* 8148 (BR), *Heutmann* in 1938 (BR). Ruanda: Nyamusha-Kogunge, *Scaetta* 1722 (†BR); Rutengeria, *Lestrade* 1 (†BR). KENYA: Mt. Aberdare, *R. E. & C. E. Fries* 798 (BR, K); Mt. Kenya, west slopes, *Mearns* 1297 (†F, GH, NY—2 sheets, †US); Lari, *Wilson* in 1921 (A, †UC-seedling), (†A), (A—4 sheets); Nairobi, Kisuru, *Dummer* 1565 (K); Kikuga Hills, *Comm. at Morubasa* (K); Muzherengira, *Elliott* 251, 255 (K); *Whyte* in 1898 (K—2 sheets); *Hutchins* in 1907 (K—3 sheets); *Hutchins s.n.* (K); *Cooper* 843 (BR); *Imp. For. Inst.* 15a (A). TANGANYIKA: Mt. Kilimanjaro, Bismarck Hill, *Greenway* 3879 (BR, K); s. slope between Umbwe & Weruweru rivers, *Greenway* 3180 (K); *Schlieben* 4862 (BR); Pare Mts. Mushange, Kipare, *Greenway* 6544 (K); East Usambara Mts., *Greenway* 4673 (K), 4899 (K); Uluguru Mts., Lupanga Peak, Morogoro, *Burt* 4714 (A, K), *Schlieben* 3153 (BR, K); Kirunga Volc., *Kassner* 3202 (K); Kondoia, Iringa Dist., *Burt* 1068 (K); Kinguassi Mt., *Burt* 920 (K), 971 (K), 1174 (K), 1345 (K—2 sheets), *Imp. For. Inst.* 70, *Wigg* (A), Mbalamu, *Adamson* 71, 72 (K). NYASALAND: north of Lake Nyasa, Kyimbila Dist., *Stolz* 387 (K); Rungnee Sta., *Stolz* 363 (GH, K); Mt. Malosa, *Whyte* in 1896 (†K); Mwanemba Point, *McClownie* 171 (K), *Johnston* in 1896 (†K), *Topham* 914 (K); below and w. of Lake Chiuta, *Cunningham* 10 (K); Mt. M'lanji, *Burt-Davy* 22023 (†A, †F), 22007 (BR), 22145 (BR), *Stolz* 373 (GH), *Whyte* 34, 39 TYPE (†BM), *Whyte* in 1891 (†K), *Buchanan* 949 (K—2 sheets), 969 (†K), *Clements* in 1924 (A), *Greenway* 3001 (K), *Greenway* 4673 (†K), *Greenway* 6300 (K). S. RHODESIA: Gazaland, Chimanimani Mts., *Swynnerton* 1962 (K); Umkali, Uumba, *Galpin* 9242 (K), *Dept. Agr.* 1167 (K); Mukungwa Valley, *Greenway & Trapnell* 5550 (K). ANGOLA: Nkanda Hills (Congo), *Dawe* 110 (†K); Dist. Bie, Cuito Rapids, N. Lisboa, *Gossweiler* 10975 (K); Sierra da Chella, Humpata, *Humbert* 16628 (†BM).

CULTIVATED: Tanganyika, *Comm. For.* A65/33 (A, BM, BR, †F, Ill, K, NY,

†Y); Horti Thenensis, *Luja* 77, *Ser. III* (†BR); Nursery Kinohop, Aberdeen Mt., *Wilson* in 1921 (A-seedlings); N. Rhodesia, Bot. Garden, *Burt-Davy* 21883 (BR).

Podocarpus ulugurensis Pilger in *Notizbl. Bot. Gart. Mus. Berlin* 12: 82. 1934.

This tree, recently described from a single collection, resembles *P. milanjanus* except for several rather striking differences. The leaves of *P. ulugurensis*, contrary to the foregoing species, have a distinctly grooved upper midrib. According to the description, the male cones have thickly coriaceous scales 4 mm. long and the cone on the type specimen measures 3 cm. long and 4 mm. wide. Study of the leaf anatomy shows extreme thickening of the cell walls in all regions. Most surprising of all, two additional resin canals are seen in the transfusion tissue, a feature found elsewhere only in certain specimens of *Eupodocarpus* from the South Pacific, *P. longifoliolatus* in New Caledonia and *P. decipiens* in the Fiji Islands.

DISTRIBUTION: In the Uluguru Mts. of Tanganyika, 2200 m. elevation, in fog forests.

SPECIMEN EXAMINED:

TANGANYIKA: Uluguru Mts., *Schlieben* 4224 TYPE (†BR).

Podocarpus madagascariensis Baker in *Jour. Linn. Soc.* 21: 447. 1885; Pilger in *Pflanzenreich* IV. 5 (Heft 18): 92. 1903, in *Nat. Pflanzenfam.* ed 2, 13: 247. 1926; Laurent in *Ann. Fac. Sci. Marseille* 23: 53. 1915; Dallimore & Jackson, *Handb. Conif.* 50, 1923, 1932; 74. 1948; Florin in *Svenska Vet.-Akad. Handl.* ser. 3, 10: 279. 1931.

Podocarpus madagascariensis, as indicated by Baker, is closely related to the foregoing species. It is a small tree indigenous to the island of Madagascar. Numerous specimens were collected by Perrier de la Bathie in 1912. An excellent study of the species and comparison with *P. elongatus*, *P. latifolius*, and *P. milanjanus* were made by Laurent (4). The size of foliage leaves and peduncle exceeds that of all the other species, and the seed (20 mm. long) is twice as large as that found in the other three species. The length of the male cone, 13 mm., is the least of any species in this group. Pilger's (6) suggestion that this species belongs to section *Stachycarpus* is unfounded.

The leaf anatomy shows the greatest degree of thickening of cell walls, to the extent that most of the mesophyll, including much of the palisade parenchyma, is thickened, with pitted walls, and much of it is devoid of cell contents. The large seed is blackish and oval in shape, 20 mm. long and 8 mm. in diameter.

DISTRIBUTION: On mountain slopes on the island of Madagascar.

SPECIMENS EXAMINED:

MADAGASCAR: Massif de Beampingaratra (Sub-Est), Mt. Papanga, *Humbert* 6398 (†A), *Baron* 2794, 3129, 3441 (†K); *Chouvenot* 107 (BM, †K); Kiknife Hills, *Warburg* 549 (K).

Podocarpus madagascariensis var. *rotundus* Laurent in Ann. Fac. Sci. Marseille 23: 59. 1915.

This variety grows at an altitude higher than that of the species. It possesses somewhat smaller leaves but larger seeds (28 mm. long).

DISTRIBUTION: Madagascar, on basalt at 1500–1800 m. altitude.

SPECIMEN EXAMINED:

MADAGASCAR: *Parker s.n.* (†Kew).

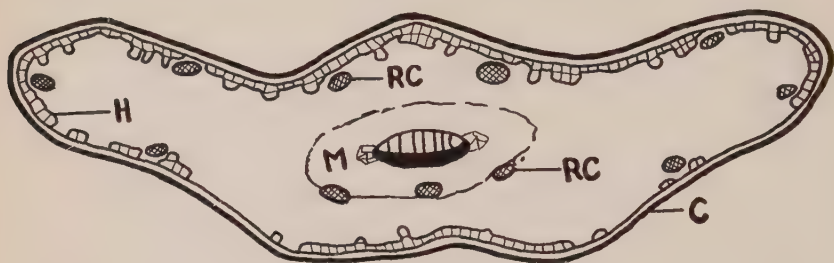
Podocarpus rostratus Laurent in Ann. Fac. Sci. Marseille 23: 60. 1915; Florin in Svenska Vet.-Akad. Handl. ser. 3, 10: 262. 1931; Orr in Trans. Bot. Soc. Edinburgh 34: 11. 1944.

This extremely rare, and perhaps now extinct, species from the island of Madagascar, is different from all other podocarp species. It is a small tree, 8–10 m. high, with somewhat shiny leaves, 2.3–3.6 cm. long and 1.25–2 mm. wide, sessile, straight, very narrowly lanceolate, gradually attenuate toward apex. Male cones solitary and sessile or in groups of 2 or 3 on a slender, 5–6.5 mm. peduncle, 10–20 mm. long and 3 mm. wide, with scales triangular and apiculate. Female cones and seeds are unknown.

The leaf anatomy shows a single midvein with two very small lateral groups of transfusion tissue, all of which is surrounded by a thick layer of parenchyma definitely distinguishable from the rest of the mesophyll of the leaf by the dense cell contents. Below the vascular bundle are 3 resin canals, one central and two lateral. Laurent (4) found a thin sheet of "irrigation tissue" on each side of the vein separating the palisade from the spongy parenchyma. We do not find this to be lignified and pitted as in true accessory transfusion tissue. There is a continuous hypoderm on the upper side of the leaf, often more than one layer thick, and it is present also between the rows of stomata below. Differing from all other podocarps, it has a number of resin canals, 6–10, around the edge of the leaf just inside the hypoderm (TEXT-FIG. 1). These were described rightly by Laurent (4) as varying in number from one leaf to another and even within the same leaf according to the position near the base, middle, or apex. Also the arrangement of the stomata into two bands on each side of the midrib, on the lower side of the leaf, is a distinctive character. The stomata show a definite Florin ring. The lack of the female structures prevents exact placing of this species taxonomically.

Laurent (4) tried to place this species among its relatives. He compared it with *P. gracillimus*, *Nelson* 423 (which has been clearly shown to belong in section *Afrocarpus*), its foliage being the same shape, but *P. rostratus* differs from it, as expected. Because *P. gracillimus* was originally in the

section *Stachycarpus*, as expressed by Pilger (6), Orr (5) attempted to place it as an aberrant member of that section. The differences listed by him, and which we have confirmed, indicate clearly the section *Eupodo-*



TEXT-FIGURE 1. *Podocarpus rostratus* Laurent. Cross-section of leaf showing relative thickness of (C) cuticle, extent of (H) hypodermal fibers, location of marginal and vascular (RC) resin canals, and the special layer of (M) mesophyll surrounding the vascular bundle and transfusion tissue. $\times 50$

carpus where continuous upper hypoderm and the three vascular resin canals are compatible. In comparison with other species, we find *P. rostratus* most closely resembles *P. acutifolius* (New Zealand) in subsection D, which is found also in Chile and Australia. In all except two characters of the leaf anatomy *P. rostratus* matches *P. acutifolius*, even to the presence of the Florin ring in the stomatal subsidiary cells.

We are placing this species in a new subsection E of *Eupodocarpus* in recognition of the following anatomical features: (1) the presence of a variable number of marginal resin canals, different from the condition in all other podocarps; (2) the double stomatal bands on the lower side of the leaf, likewise not found in any other podocarps; (3) the three vascular resin canals found in African and Asiatic *Eupodocarpus* but not in sections *Afrocarpus* nor *Stachycarpus*.

DISTRIBUTION: Madagascar, on high summits of Mt. Tsaratana, in forests almost destroyed by fire.

SPECIMEN EXAMINED:

MADAGASCAR: Mt. Tsaratana, H. Perrier de la Bathie 10443 (†ex Florin, Riksmuseet, Stockholm).

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THE IDENTITY OF VALENTINIA ILICIFOLIA SWARTZ

RICHARD A. HOWARD AND CLAUDE E. SMITH, JR.

THE ILICIOID CASEARIAS of Cuba have been studied recently by Fr. Marie-Victorin (Contrib. Inst. Bot. Univ. Montreal 49: 19-56. 1944) who discussed the confusion existing between *Casearia ilicifolia* Vent. and *Valentinia ilicifolia* Sw. At that time Marie-Victorin did not have at his disposal information on the type specimens of these two species, nor the recent collections from Hispaniola which allow a more satisfactory description and disposition of these species.

The genus *Valentinia* was described by Swartz (Prod. 63. 1788 and Flor. Ind. Occ. 2: 689-90, t. 14. 1800) based on descriptions and illustrations by Plumier (Cat. in add. 46. 1703, and ed. Burm. 160, t. 167. 1755) and Plukenet (Phytographie 196, fig. 3. 1691) as well as new material which Swartz illustrated. The genus contained one species, *Valentinia ilicifolia*. The genus and species were transferred to *Casearia* and placed in the section HEXANTHERAE by Bentham and Hooker (Gen. Pl. 1: 796. 1867). The section HEXANTHERAE of the genus *Casearia* had been established earlier by Endlicher (Gen. Pl. 917, 1840) for a single species, *Casearia ilicifolia* Ventenat. Endlicher had considered the Swartz genus *Valentinia* as of doubtful position. Bentham and Hooker, in referring *Valentinia* to *Casearia*, implied the identity of *Valentinia ilicifolia* Sw. and *Casearia ilicifolia* Vent. but did not specifically transfer the Swartz species. Eichler in 1871 [Flor. Bras. 13 (1): 462. 1871] cites *Valentinia ilicifolia* Sw. in synonymy with *Casearia ilicifolia* Vent. It appears, however, that Urban (Symbol. Ant. 8: 446. 1920) was the first to publish the actual combination *Casearia ilicifolia* (Sw.) Vent. implied by the earlier workers and generally accepted in the literature today. Urban was in error in making or accepting such a combination, for *Casearia ilicifolia* Vent. and *Valentinia ilicifolia* Sw. are actually two distinct species although both belong to the genus *Casearia*. It should be noted here that Urban cited in synonymy with *Casearia ilicifolia* (Sw.) Vent., *Valentinia ilicifolia* Sw. as the basonym and also *Casearia comocladifolia* Vent.

Urban apparently recognized discordant elements in the original publication of *Valentinia ilicifolia* which Swartz had based on a Plumier reference and figure as well as material of his own. The Plumier figure was considered by Urban in several subsequent discussions. In 1919 (Fedde Rep. Spec. Nov. 15: 403-4. 1919) he concluded Plumier's illustration could not be a *Malpighia* as Plumier had suggested and might possibly be an undescribed species of a different or possibly new genus but that it was not the same as *Valentinia ilicifolia* Sw. In his consideration of Plumier's life and writings in 1920 (Fedde Rep. Beih. 5: 75. 1920) Urban continued to call the Plumier figure *Valentinia ilicifolia* Sw. but reported it as a tree of dubious affinities. Finally in 1922 (Fedde Rep. Spec. Nov. 18: 365-6.

1922) Urban decided that the Plumier illustration was comparable to recently acquired herbarium specimens and these he described as *Sloanea ilicifolia* spec. nov. He cited in synonymy "V. ilicifolia Sw. quoad syn. Plum." Unfortunately Urban added to the confusion by using the same specific name and called this species *Sloanea ilicifolia*. We conclude that Urban did not intend to imply a new combination here as he referred the species *Valentinia ilicifolia* Sw., represented by the Swartz description and material, to *Casearia* in the same year.

Marie-Victorin, without access to the type specimens concluded it was difficult to determine what the Swartz species actually was and accepted Urban's disposal of the name *Valentinia ilicifolia* as a new combination in *Casearia*. We now have photographs of the type collections of *Valentinia ilicifolia* Sw. and *Casearia ilicifolia* Vent. In addition we have been aided by Dr. Ivan Johnston who examined the Swartz material of *Valentinia ilicifolia* in the British Museum.

The Swartz material is definitely a member of the genus *Casearia*. However, to transfer *Valentinia ilicifolia* Sw. to the genus *Casearia* as past workers have done would create a later homonym for *Casearia ilicifolia* Vent., a completely distinct species, hence a new name must be found. Gomez and Molinet recognized this transfer difficulty and created the name *Casearia Valentinia* for *Valentinia ilicifolia* Sw. (Gomez de la Maza, Flor de Cuba 33. 1887), however an earlier name is available. In 1803 Ventenat described a pubescent leafed *Casearia* which he called *C. ilicifolia* and a glabrous leafed species which he called *Casearia comocladifolia* (Choix de pl. 44. 1803). The latter was correctly recognized by Urban as identical with *Valentinia ilicifolia* Sw. and cited in synonymy when Urban referred the Swartz species to *Casearia* as *Casearia ilicifolia* (Sw.) Vent. (Symbol. Ant. 8: 446. 1920). Marie-Victorin also accepts *C. comocladifolia* Vent. for the common glabrous, usually membranaceous ilicioid leafed *Casearia* of Hispaniola and Cuba; however, he did not recognize this was the same as *Valentinia ilicifolia* Sw. The correct nomenclature should be:

***Casearia comocladifolia* Vent. Choix de pl. 44. 1803.**

Valentinia ilicifolia Sw. Prod. 63. 1788; Flor. Ind. Occ. 2: 689-90, t. 14. 1800.

Casearia Valentinia Gomez and Molinet, Gomez de la Maza, Flor. de Cuba 33. 1887.

The pubescent leafed *Casearia ilicifolia* Vent. is well described and illustrated in the original publication (Choix de pl. 44. 1803), and is clearly distinct. This species was discovered by Turpin near Monte Cristi in Santo Domingo around 1800. Turpin himself did the illustration for Ventenat. It is clear from the original description that Ventenat was describing a new species and not transferring the earlier Swartz name to *Casearia* as Urban, Moscoso (Cat. Flor. Doming. 386. 1943), Gilg. (Nat. Pflanzenfam. ed. 2, 21: 453. 1925) and others imply. The correct nomenclature for this species is:

Casearia ilicifolia Vent., *Choix de pl.* 44. 1803.

Samyda ilicifolia (Vent.) Poiret, *Lam. Encycl. Suppl.* 5: 31. 1817.

The lack of any collections of this species since 1800 have handicapped most recent considerations of this problem. In 1946, the senior author relocated the species near Monte Cristi in the Dominican Republic. Additional material was collected in 1950 and it was determined that the species is abundant in restricted locations and has only been overlooked by past collectors in the dry thorn shrub vegetation around Monte Cristi. The following description of *Casearia ilicifolia* Vent. has been compiled from a field knowledge of this species and the additional collections cited below.

Casearia ilicifolia Vent.

Spreading bushes 10 feet tall or trees 15–18 feet tall with trunk diameter averaging 4 inches at breast height. Branches occasionally geniculate and the youngest twigs densely pilose. Petioles 2–3.5 mm. long, densely pilose. Leaves oblong in outline, 5.5×3.0 to 7.0×3.0 cm. long and broad, coriaceous; apex truncate-emarginate tipped by two spines to slightly rounded; base truncate to truncate-cordate; margin strongly sinuate, spinose, the 10–13 lateral spines and ultimate leaf margins distinctly cartilaginous; primary veins 6–9 pairs, arcuate anastomosing near the margin with strong branch veins running into the spines; the blade lightly pubescent becoming glabrate and shining above, densely persistently pilose below. Flowering pedicels 3–4 mm. long; hypanthium 0.5 mm. long. Sepals 6, united at the base, pink, 6.5×2.3 to 7.5×3.5 mm. long and broad, densely short pilose outside, sparsely pubescent inside; corolla wanting; filaments and staminodes 8, thinly united at the base, the union 1.5 mm. long, the free portions of the filaments 2 mm. long, the free portions of the staminodes 1.5 mm. long, staminodes attenuate, filaments and staminodes sparsely short pilose, anthers affixed near the base, 1 mm. long; ovary globose, 3.0–3.5 mm. in diameter, short pilose above the middle, glabrous below, style 2.5–3.0 mm. long, sparsely short pilose, stigma capitate, 3-sided, apex depressed; fruiting pedicels 5–8 mm. long, the mature fruit a yellow-orange berry, depressed globose, 1 cm. in diameter, splitting along 3 lines, the pulp red, the seeds 4–8, yellow.

SPECIMENS SEEN:

DOMINICAN REPUBLIC: prov. Monte Cristi: Villa Isabella, *Howard 12520* (GH); Banks of the Rio Yaqui del Norte, south of Monte Cristi, *Howard 9570* (GH). Collected in flower and fruit in July and August.

Previous workers have been troubled by the earlier cited ranges of these species. Swartz, in the original publication of *Casearia comocladifolia* (*Valentinia ilicifolia* Sw.) gave the location as "habitat in sterilissimis petrosis Hispaniola, versus Oceanum. In Cuba circa Havanam." The species has never been relocated near Havana although collections are known from the Oriente Province of Cuba. In Hispaniola the current loca-

tions for this species are Gonaïve Island and near Port au Prince in Haiti and near Barahona and Monte Cristi in the Dominican Republic. The Barahona location is a new record and is based on the collection *Howard 12599*. This was made from a 15 foot tree which had pink flowers which appeared while the plant was in full leaf. It was collected in flower in August and was growing in the thorn shrub area north of the town of Barahona.

Marie-Victorin refers both *Casearia ilicifolia* and *Casearia comocladifolia* to the section HEXANTHERAE DC which he emended. The primary character listed by Marie-Victorin is the production of flowers before the leaves appear. The two species considered here, which the senior author has seen in the field, may be leafless when flowering; may produce flowers on terminal leafless branches while the rest of the plant possesses leaves (*Howard 9570*), or may be in full leaf when flowering with the flowers hidden in the dense foliage (*Howard 12559*). The character of hysteroanthous flowers as used by Marie-Victorin is not reliable.

The number of stamens in the species of the section HEXANTHERAE is also variable. Marie-Victorin distinguishes *Casearia comocladifolia* by having six stamens. However, Marie-Victorin's own dissections of a Gray Herbarium specimen of *Casearia comocladifolia* (*Wright 12*) with the open flowers spread on cards show flowers with six, seven and eight stamens and so indicated in Marie-Victorin's handwriting. The original plate given by Swartz in describing *Valentinia ilicifolia* shows eight stamens and the recent collections of this species from the Dominican Republic have most of the flowers with eight stamens, a few with seven and a very few with six stamens. Recent collections of *Casearia ilicifolia* also have flowers with eight stamens. The name of the section HEXANTHERAE is deceptive.

We can return now to a consideration of *Sloanea ilicifolia* Urban. In the original publication of this species Urban cited in synonymy "*Valentinia ilicifolia* Sw. quoad syn. Plum." In his citation of specimens Urban refers first to the Plumier figure and then to collections. No type was specifically selected. The original description is to a large extent based on a flowering specimen collected by Père Straessle at Morne Bellefontaine. All other specimens cited are indicated as sterile. The Straessle collection is presumably destroyed having been at Berlin. Only one of the other collections, *Leonard 3797a*, is available in this country.

In 1929 Urban and Ekman [*Arkiv Bot.* 22A (17): 26. 1929] described a second species of *Sloanea* with ilicioid leaves which they called *Sloanea castor*. The distinctions between *Sloanea ilicifolia* and *Sloanea castor* do not seem reliable; the flowers and fruits are similar and the leaves of the two species show all intergradations in the material now available to us. Furthermore the ranges of the two entities coincide. It appears to us that *Sloanea castor* Urb. and Ekman must be reduced to synonymy with *Sloanea ilicifolia* Urb. An emended description of this species, based on the available collections, follows.

Sloanea ilicifolia Urban, Fedde Rep. Spec. Nov. 18: 365. 1922.

Sloanea castor Urban and Ekman, Arkiv Bot. 22A (17): 26. 1929.

Tree 15–20 m. tall. Branchlets with brown or grey-brown bark, scarcely striate to rough. Twigs more or less sulcate, scarcely to densely light brown puberulent. Leaves alternate to opposite, often clustered on many twigs towards the ends of the branchlets; stipules caducous, 3.5–4.5 mm. long, linear-lanceolate, light brown pubescent; petioles 3.0–12.0 mm. long, terete, scarcely incrassate at both ends, light brown puberulent; blade very variable in size and shape, 3.5×2.2 to 12.5×9.5 cm. long and wide, elliptic-lanceolate to broadly oval, stiff coriaceous, midrib and secondary veins impressed, scantily puberulent to glabrous above, prominent, puberulent to glabrous beneath, secondary veins 4 to 8, arcuate-ascending, generally terminating in a spine at the leaf margin, tertiary venation irregular, occasionally terminating in a marginal spine, base rounded to cordate, apex rounded to acute to short acuminate, the midrib prolonged into a spine, margin irregularly and deeply spinose dentate. Inflorescences axillary to leaf scars, one to several flowered; flowers 3.0–4.0 mm. long, about 4.0 mm. in diameter, sepals generally 6, to 3.0 mm. long, 0.5–1.25 mm. wide at the base, lanceolate-deltoid, obtuse, densely puberulent within and without; stamens 2.0–3.0 mm. long, filaments 1.5–2.0 mm. long, puberulent to pubescent, anthers 0.75–1.0 mm. long, deltoid, puberulent, dehiscing linearly most of their length, connective prolonged into a short knob above the anther sacs; pistil to 3.0 mm. long, ovary 1.0–2.0 mm. long, densely pubescent, indistinctly 4-angled, 4-loculed, gradually giving rise to the style, style often divided to the ovary to form two parts each of which may be divided again at the apex, pubescent at the base, glabrous above. Capsule brown, 1.5–1.75 cm. long, 1.25–1.5 cm. in diameter, subglobose to ellipsoidal, 1-loculed, 1–2-seeded, 3–4-valved; valves with velutinous outer surface densely covered with flexible spines; spines to 1.5 cm. long, densely antrorsely puberulent, straight, abruptly acute. Seeds enclosed almost completely in a deeply 3-lobed red aril which is firmly attached to the chalazal quarter of the seed.

SPECIMENS SEEN:

DOMINICAN REPUBLIC: Prov. of Barahona, Monteada Nueva, S.E. of Polo, alt. 3500 ft. *R. A. Howard* 12355, 50 ft. tree with small buttresses, d.b.h. 3 ft., fruit brown, Aug. 3, 1950 (GH); Prov. of Azua, Cordillera Central, Las Lagunas, 2250 ft., *E. L. Ekman* H6366, quite common tree, flowers past anthesis, July 13, 1926 (S).

HAITI: Vicinity of Mission, Fonds Varettes, alt. about 3000 ft., *E. C. Leonard* 3797a (CO-TYPE), occasional tree, steep wooded mountain slope, sterile, April 17–May 4, 1920 (NY, S); Massif de la Hotte, western group, Les Roseaux at Nan-Patates, 3000 ft. alt., *E. L. Ekman* 10690 (TYPE of *S. castor*), common tree, in flower and fruit Sept. 17, 1928 (S, US); Massif de la Hotte, western group, Jeremie, Source-Cahouane, alt. 600 ft., *E. L.*

Ekman H10234, in fruit July 4, 1928 (S); Massif de la Hotte, western group, Torbee, La-Marie-Praux, alt. 2100 ft., *E. L. Ekman H5399*, sterile on Dec. 8, 1925 (S); Massif de la Selle, Morne Tranchaut, Fourcy, alt. 4620 ft., *E. L. Ekman H1285*, sterile on Aug. 4, 1924 (S); Massif du Nord, Port-de-Paix, high ridge of Haut Piton, alt. 3000 ft., *E. L. Ekman H3706*, sterile on April 6, 1925 (S); Petit Source, Morne de Commissaires, alt. 4560 ft., *L. R. Holdridge 1930*, tree 15 m. tall, d.b.h. 3 dm., in flower Sept. 1, 1944 (GH, US); Riviere Glace, alt. 2250 ft., *L. R. Holdridge 2219*, tree 20 m. tall, d.b.h. 3 dm., in flower and fruit Aug. 7, 1945 (US).

The figures given by Plumier and Plukenet agree with the specimens cited above.

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NEW SPECIES AND DISTRIBUTION RECORDS FOR
LAS VILLAS PROVINCE, CUBA

RICHARD A. HOWARD AND WINSLOW R. BRIGGS

SEVERAL NEW SPECIES and significant extensions of known ranges of distribution were encountered in the course of general collecting and field work in southern Las Villas province of Cuba in the summer of 1951. These are reported in this paper.

The authors, instructor and member of the class in Tropical Botany of Harvard University, wish to express their appreciation to the other members of the class for their assistance during this work. Duplicate specimens are to be distributed and will cite as collectors, R. A. Howard, W. Briggs, I. Lane, P. Kamb, and R. Ritland. The many services supplied by Dr. I. D. Clement, economic botanist in charge of the Atkins Garden and Research Laboratory which was our headquarters for this work, are gratefully acknowledged by the authors speaking for the entire group.

Dorstenia Lanei sp. nov.

Herba acaulis; rhizomatibus erectis, cylindricis, crassis, 13–18 mm. longis, 3–4 mm. crassis; stipulis 0.4–0.6 mm. longis, ad 0.2 mm. latis, anguste acuminatis, minute puberulentis. Folia peltata, purpureo-grisea, orbiculari-ovata, 18×15 , 15×12 vel 9×8 mm., apice rotundata, basi saepe truncata, ad medium inserta, margine undulata vel crenulata, supra glabra sicco paullo scabrida, subtus puberulenta, petiolis glabris 4–7 cm. longis basi etiolatis glabrisque, apice purpureis puberulentisque. Inflorescentia cyathiformia; pedunculis 8–20 mm. longis, ad apicem puberulentis; receptaculo 4–5 mm. diametro, peltato, puberulente, purpureo-rubiginoso, margine 6–10 dentibus triangularibus horizontalibus inaequalibus, 0.4–0.8 mm. longis; floribus ♂ et ♀ intermixtis, floribus ♂ verdis, floribus ♀ albis.

CUBA: Las Villas Province: 10 kms. south of Santa Clara on the road to Manicaragua, *Howard, Briggs, et al.* 69 (TYPE, GH). Collected in flower July 5, 1951.

This is a unique species of *Dorstenia*, distinctive in its habit in the field and the first species known to us to occur on serpentine soil. The erect rhizome of *Dorstenia Lanei* is entirely buried so that the blade of the peltate leaf appears to be flat on the surface of the ground and the receptacle opens flush with the surface of the soil. The peduncle and petioles are all etiolated at the base and show pigmentation only at the immediate

apices. The venation of the leaf blade is palmate from the point of attachment of the petiole. All the veins bifurcate once before reaching the margin. The midrib is not particularly distinct, appearing of the same size as the other veins and is not pinnately branched.

Dorstenia Lanei, named for Irwin Lane who discovered the first specimen in the field, is most nearly allied to *D. erythrandra* Wr. ex Griseb. but differs in habit, size and leaf venation.

Erythrina Elenae sp. nov.

Arbor ad 10 m. alta; truncus 30 cm. diametro, spinis suberis, magnis, persistentibus; ramulis aculeatis, spinis 5–6 mm. longis. Folia pinnata, pinnis 3; petiolis inermibus, 6.5–11.5 cm. longis, glabris; petiolulis 2–3 mm. longis, 0.4–0.7 mm. crassis, fuliginosis, puberulentis vel glabris, rugosis; stipellis 0.5 mm. longis, fuliginosis, glandulosis; foliolis 3, inermibus, glabris; foliolis terminalibus lanceolatis vel lanceolato-ovatis, 3–13 cm. longis, 0.4–2.8 cm. latis, late acuminatis, basi rotundatis, infra medium latissimis, nervis lateralibus 8–20, nervis secundariis prominente reticulatis, margine integro; foliolis lateralibus similibus aliquando brevioribus. Flores non visi. Inflorescentia subterminalis, racemosa, lignosa, ad basin tumida, ad apicem attenuata, ad 13 cm. longa; pedicellis lignosis, 4–7 mm. longis, 1.5–2.5 mm. crassis. Legumina usque 2.5 cm. stipitata, 5–8 cm. longa, 7–8 mm. lata, moniliformia, fuliginosa, sublignosa, glabra, apice 1.8–2 cm. arcuato-rostrata. Semina 2–5, ovalia, 6–8 mm. longa, scarlatina.

CUBA: Las Villas Province: limestone hillside $\frac{1}{4}$ mile west of the spot where the Camino de la Sur crosses the Rio San Juan along the south slope of the Trinidad Mountains. Howard, Briggs, et al. 377 (TYPE, GH). Collected in fruit July 17, 1951.

The lanceolate to lanceolate-ovate glabrous leaflets of *Erythrina Elenae* set this species so distinctly apart from any other species reported from the Antilles that a satisfactory comparison is not possible with any of them. The specimens were collected in fruiting condition and until the flowers are known the species can not be assigned to any section in the genus.

Erythrina Elenae is respectfully named for Mrs. William Claflin, nee Helen Atkins, in appreciation of her active interest in the flora and the study of botany in Cuba.

Tetrazygia aurea sp. nov.

Frutex vel arbor parva, ad 5 m. alta. Folia anguste oblonga, lamina 4–5 cm. longa, 1–1.5 cm. lata, apice attenuata demum incurvata, in mucrone 0.4–0.5 mm. longo terminata, basi rotundata, supra nitida, glabra, subtus ferrugineo-stellata margine incurvata, nervis primariis 3, subtus prominentibus, supra prominenter impressis, nervis secundariis rectis angulis divergentibus. Inflorescentia terminalis, paniculata, floribus 5, raro 7; calyx undulatus; petala 5–6, 8–10 mm. longa, 5–6 mm. lata, rosea, obovata vel orbicularia, unguiculata; stamina 10–12, antheris 5 mm. longis, fila-

mentis 7 mm. longis; ovarium 5- vel 6-loculare, ovulis plurimis; stylis gracilibus, 11 mm. longis, ad apicem attenuatis, stigma punctiforme. Fructus depresso-globosus, 5- vel 6-locularis, 7-8 mm. diametro, pedicello 2 mm. longo (fructus pedicellusque persistente ferrugineo-stellatus); semina plurima, cuneiformia, 1 mm. longa, pars una adusta, pars altera castanea.

CUBA: Las Villas Province: Gaviñas, Trinidad Mountains, *Howard* 6447 (TYPE, GH); Las Vegas de Mataguá, Trinidad Mountains, *Jack* 5953; Buenos Aires, Trinidad Mountains, *Leon, Jack & Rowe* 13936, *Smith, Hodgdon & Gonzales* 3383; El Purial on Rio Banao, Lomas de Banao, *Ekman* 16236.

The cited collections have all been named *Tetrazygia elaeagnoides*, a species which differs from *T. aurea* in having a cinereous pubescence, glabrate fruits, dull and acuminate leaves, 4-parted flowers and a strongly 4-lobed fruit. The specific epithet is derived from the golden color of the leaves.

***Pectis Ritlandii* sp. nov.**

Herba prostrata. Folia oblongo-linearis, 5-8 mm. longa, 1-2 mm. lata, apice acuta et spinulosa, margine 3-4 paribus setarum, praecipue basin versum, non ad apicem, glandulosa, glandulis submarginalibus, uniseriatis, 4-9 per marginem. Capitula solitaria, terminalis; pedunculis 5-11 mm. longis, glabris; involucro campanulato, 4-5 mm. longo; phyllaribus 5, lineari-obovatis, acutis vel obtusis, basi gibbosis, carinatis, dorso glandulosis, glandulis oblongis irregulariter dispositis, margine scariosis hyalinis; floribus ligulatis 5, ligulis luteis, ad 5 mm. longis; floribus discoideis 4-8, corollis ad 3.5 mm. longis; pappi setis numerosis, inaequalibus, maturitate ad 2 mm. longis, scabris, pilulis minute excurrentibus.

CUBA: Las Villas Province: on coastal rocks between Punta Lobas and Pasa Caballos, *Howard, Briggs, et al.* 357 (TYPE, GH); Castillo de Jagua, *Howard* 4219.

Pectis Ritlandii is named in honor of Richard Ritland who collected the first specimens. The species is most closely related to *Pectis Leonis* Rydb. which is known only from savannahs north of the Sancti Spiritus mountains. *Pectis Leonis* differs from the present species in having the stem and branches rough pubescent; the glands in the leaves about 16 in number, and the margins of the phyllaries purplish.

***Xylosma Shaferi* (Wils.) comb. nov.**

Myroxyton Shaferi P. Wilson, *Torreyia* 30: 73. 1930.

***Tillandsia argentea* Griseb.**

CUBA: Las Villas Province: forest on hillslope west of Rio San Juan crossing on the southern slopes of the Trinidad mountains, *Howard, Briggs, et al.* 367.

This small silvery *Tillandsia* was described by Grisebach on a Wright specimen collected at Monteverde in Oriente province. It has since been reported from Jamaica in the Greater Antilles. The current collection is the first record of its occurrence in Las Villas province.

Cattleyopsis Lindenii (Lindl.) Cogn.

CUBA: Las Villas Province: thorn shrub on the Camino de la Costa, west of Juraguá, *Howard, Briggs, et al.* 245.

This species has a wide distribution in Cuba, the adjacent Bahama Islands, and Jamaica but has not been reported previously from Las Villas.

Tetramicra erosa Carabia

CUBA: Las Villas Province: dry hillside 10 kms. south of Santa Clara on serpentine soil, *Howard, Briggs, et al.* 293.

Previously known from the Oriente province of Cuba this is the first record of the species from Las Villas.

Croton prostratus Urban

CUBA: Las Villas Province: dry hillside 10 kms. south of Santa Clara on serpentine soil, *Howard, Briggs et al.* 78.

The type collection and a single additional collection of this species were made by Ekman on Sierra de Nipe in Oriente province. The current collection was made from a few plants growing in association with *Croton nummularifolius* in an open savannah.

Leucocroton revolutus Wright

CUBA: Las Villas Province: dry hillside 10 kms. south of Santa Clara on serpentine soil, *Howard, Briggs et al.* 107.

The type collection of this species was made in Pinar del Rio province. It is also known from the Oriente province. This collection represents the first material from central Cuba.

Linociera bumelioides Griseb.

CUBA: Las Villas Province: thorn shrub along the Camino de la Costa south of Juraguá, *Howard, Briggs et al.* 238.

A widely distributed species not previously recorded from Las Villas province.

Heliotropium hypogaea Urb. and Ekman

CUBA: Las Villas Province: Camino de la Costa west of Juraguá, *Howard, Briggs et al.* 226.

Heliotropium hypogaea was described by Urban and Ekman based on material collected on Gonave Island off Hispaniola. The collection cited

above is the first record of this interesting plant from Cuba. A small colony of this species was found growing on sandy soil in a thorn shrub thicket. The plants were in flower on July 11, 1951, and the corollas were white with yellow throats. Mature fruits had elongated peduncles and were pushed into the ground as described by Urban and Ekman. The species is distinctive in the genus *Heliotropium* in having these hypogeous fruits.

***Tecoma microphylla* (Lam.) Urban**

CUBA: Las Villas Province: thorn shrub along the Camino de la Costa, south of Juraguá, *Howard, Briggs et al.* 256.

Like the preceding species *Tecoma microphylla* has been found only on Gonave Island off Hispaniola. This is the first record for this handsome shrub in Cuba.

***Guettarda rigida* A. Rich.**

CUBA: Las Villas Province: dry hillside 10 kms. south of Santa Clara on serpentine soil, *Howard, Briggs et al.* 73.

This species has been collected previously in Matanzas province and the current collection represents the first record from Las Villas.

***Machaonia microphylla* Griseb.**

CUBA: Las Villas Province: forested hillslope west of the Rio San Juan crossing on the southern slopes of the Trinidad mountains. *Howard, Briggs et al.* 397; San Blas — Buenos Aires area, *Howard* 6537.

This handsome 15 foot shrub has attractive white flowers with a strong and pleasant odor. The plants were extremely attractive to bees and might well be cultivated as ornamentals or honey plants. The collection made by the Tropical Botany class will be distributed as an Exsiccata of the Gray Herbarium. The two collections cited above are the first records of this species from Las Villas province.

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THE STRUCTURE AND DIAGNOSTIC SIGNIFICANCE OF CRATERIFORM BORDERED PITS IN THE VESSELS OF CERCIDIUM

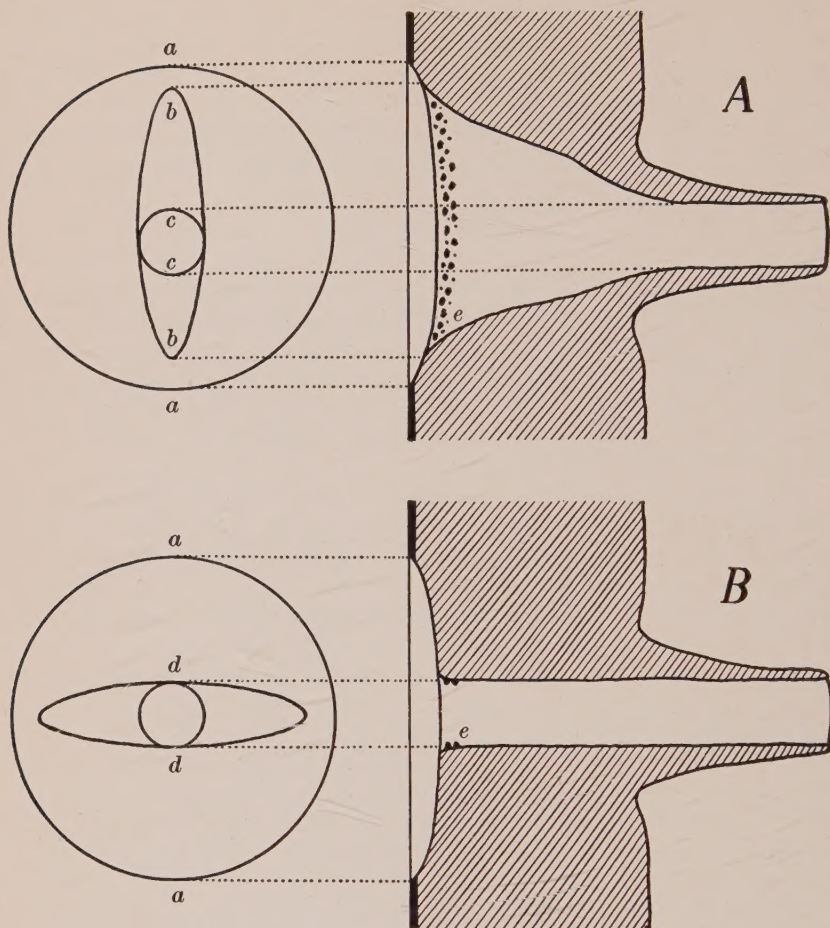
DOMINGO COZZO

THE PECULIAR PITS in the vessels of *Cercidium australe* Johnston were first described and figured by Tortorelli & O'Donell (1937), who considered them to be "vestured pits" such as occur throughout most of the Leguminosae with the exception of the Bauhineae, Bailey (1933). In connection with my investigations (1950, 1951) of Argentine Leguminosae, I noted certain unusual characteristics of these pits which led me to believe that they merited detailed reinvestigation.

The vessels of *C. australe* are studded internally with projections which resemble miniature volcanic cones. Each of these projections contains a craterlike cavity that extends from its apex through the thick secondary wall of the vessel into the chamber of a bordered pit. According to the terminology adopted by the International Association of Wood Anatomists (1933), an extended opening through a thick secondary wall — which provides a means of communication between the lumen of a cell and the chamber of a bordered pit — is called a "pit canal." A pit canal has an "inner aperture" that opens into the lumen of the cell, and an "outer aperture" that leads into a "pit chamber." Thus, the projections in the vessels of *C. australe* are not a form of vesturing, but are excessive inward extensions of localized parts of the secondary wall which surround the pit canals. True vesturing¹ of the bordered pits in *C. australe* is confined largely to the rim of the outer aperture of the pit canal.

The detailed structure of this aberrant type of bordered pit in *C. australe*, Fig. 1, A and B, differs from the usual type in the following respects. In the case of tracheids and vessels with thin secondary walls, the area of the wall which jackets the pit chamber is embossed inwardly beyond the general contour of the wall which surrounds the lumen of the cell. With increasing thickness of the secondary wall and reduction in size of the pit chamber, this embossing effect is submerged and concealed. In very thick-walled vessels and fiber tracheids, having circular bordered pits, the outer aperture of the pit canal tends to be circular, but of conspicuously smaller diameter than the circular outer contour of the pit chamber. The pit canal flares toward the lumen of the cell by an enlargement of one of its diameters, and the inner aperture usually is more or less narrowly elliptical or slit-like. In the vessels of *C. australe*, on the contrary, the inner aperture of

¹In my opinion, the term "ornate" is preferable to "vestured." In any case, the Spanish term "orladas" as applied to this type of structure should be changed to "ornadas," the correct translation of both "vestured" and "ornate."



TEXT-FIGURE 1. Crateriform bordered pits in surface and sectional views. (A) Sectioned parallel to the long axis of the outer aperture of the pit canal. (B) Sectioned at right angle to (A). (a-a) Contour of pit chamber, (b-b) contour of outer aperture, (c-c) contour of inner aperture, (d-d) coincident diameters of inner and outer apertures, (e) vestured rim of outer aperture.

the extended pit canal is small and circular. Furthermore, the pit canal flares outwardly, being broadly elliptical at the level of its outer aperture.

TAXONOMIC CONSIDERATIONS

Crateriform bordered pits occur in the vessels of the first-formed, as well as the later-formed, secondary xylem of the stem. Therefore, it is possible to study their occurrence in small twigs from herbarium specimens. Their presence or absence in material obtained from the Arnold

Arboretum (AA), Gray Herbarium (GH), Museo Argentino de Ciencias Naturales (BA), Yale Forestry School (YF) and the Wood Collection of Harvard University (HU) is as follows:

CRATERIFORM PITS PRESENT

Cercidium australe Johnston: Argentina, Mendoza, *Mexia* 4377 (GH); Argentina, La Rioja, *Cozzo* (BA, 52235); Argentina, Salta, *Cozzo* (BA, 52722), *Venturi* 9507 (AA).

Cercidium praecox (R. & P.) Harms: Argentina, Jujuy, Ledesma, *Venturi* 5343 (GH); Peru, Lambayeque, *J. West* 3576 (GH); Ecuador, Loja, *Hitchcock* 21331 (GH); Venezuela, *Pittier* 12945 (AA), *Pittier* 1928 (YF, 12458); Venezuela, Llavo, *Curran* and *Haman* 1251 (GH); Mexico, Sonora, La tinajo, *Hartman* 241 (GH); Mexico, Sonora, *Abrams* 13287 (GH).

CRATERIFORM PITS ABSENT

Cercidium andicola Gris.: Argentina, Jujuy, *DeCarles* (BA, 27/1102); Argentina, Jujuy, Maimará, *Lorentz & Hieronymus* 746 (GOET, TYPE); Argentina, Jujuy, Humahuaca, *Schreiter* 11085 (GH); Bolivia, Toldos bei Bermejo, *Fiebrig* 2493 (GH).

Cercidium floridum Benth.: Mexico, Nuevo Leon, *T. C. and E. M. Frye* 2391 (GH); Mexico, Sonora, *Wiggins* and *Rollins* 272 (HU, 25775); Mexico, Sinaloa, *Gentry* 7016b (GH); U.S., Arizona, *Pringle* 1881 (AA).

Cercidium macrum Johnston: Mexico; Victoria, Tamaulipas, *Palmer* 125 (GH); U.S., Texas, *Palmer* 12303 (AA).

Cercidium microphyllum (Torr.) Rose & Johnston: U.S., Arizona; *Brass* 14360 (GH); U.S., California, *Epling*, *Haines* and *Stewart* 1933 (AA); *Pringle* 1882 (AA); *HU* 9678.

Cercidium molle Johnston: U.S., Gulf of California, *Johnston* 3877 (AA).

Cercidium peninsulare Rose: U.S., Gulf of California, Carmen Island, *Johnston* 3802 (GH).

Cercidium sonora Rose & Johnston: Mexico, Sonora, *Abrams* 13280 (GH).

Cercidium texanum Gray: U.S., Texas, *Buckley* 1881 (AA).

The constant occurrence of crateriform bordered pits in two species of *Cercidium*, and their absence in eight other species, provides a diagnostic character of considerable significance; one which may be utilized by taxonomists in any future revision of the genus and its species. The character is so peculiar and unusual that it is indicative of close relationship between *C. australe* and *C. praecox*. It serves to differentiate these species sharply from *C. andicola*, as well as from North American representatives of the genus.

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